

August 6, 1962

SPECIAL REPORT:

NATO F-104G

Management  
Problems

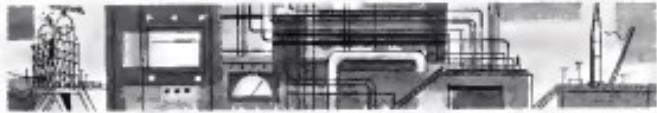
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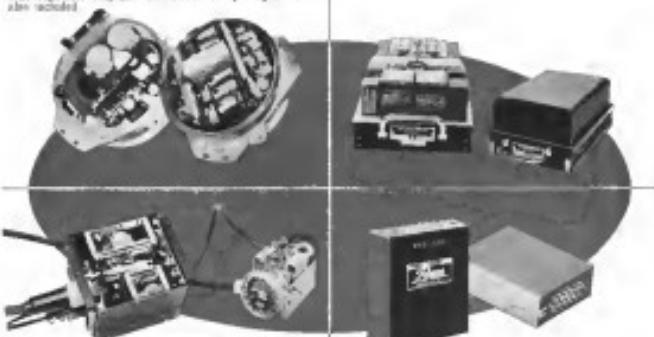
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See our study at WHOON—Tables 102 and 103.

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AEROSPACE CALENDAR

- Aug. 13-16—Pacific Electric Communications Conference, American Institute of Electrical Engineers, Fairmont Hotel, San Francisco.

Aug. 13-16—Seventh Symposium on Relistic Speech and Sound Technology, U.S. Air Force Academy, Colorado Springs, Colo. Sponsored by USAF Aerospace Corp.

Aug. 14-15—Circuit Engineering Conference, University of California at Los Angeles, Los Angeles, Calif.

Aug. 14-16—International Conference on Solid-State Electronics Measurements, Boulder Laboratories, National Bureau of Standards, Boulder, Colo.

Aug. 15-17—Vacuum Techniques Conference, Montana, Calif. Joint Meeting, Institute of the Aerospace Sciences, Vienna, Austria, and American Rocket Society, (Orlando, Fla.)

Aug. 15-27—Third International Electronic Circuit Packaging Symposium, University of Colorado, Boulder, Colo.

Aug. 18-20—Electroacoustics Institute, Lafayette, Ind. Group III Analysis of the French Acoustic Legend in Relation to Acoustics, Battelle, Grand Rapids, Mich.

Aug. 19-25—Annual Meeting and Conference, Airport Operators Council, Phoenix, Arizona Hotel, Phoenix, Ariz.

Aug. 20-22—Tenth Annual Session, Firestone International Management Association, Arco Hotel, Los Angeles, Calif.

Aug. 21-24—Western Electronics Show and Conference, Institute of Radio Engineers, Los Angeles, Calif.

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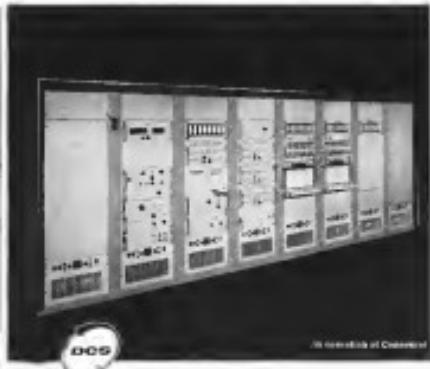
ASSESSMENT POLICY AND SOURCE DETERMINATION

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FEBRUARY 1955  
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AEROSPACE CALENDAR

(Continued from page 5)

**Aug.** 23-24-International Symposium on Infrared Spectroscopy, Boston, Mass. at Hotel Congress, Glendale Springs, Calif. Sponsored by Mineral, Chemical, Analytical, and Disease Analysis Bureau, National Bureau of Standards, Washington, D. C.

**Aug.** 23-24-1944 Session, International Civil Aviation Organization Assembly, Kuala Lumpur, Malaya.

**Aug.** 23-24-Quarterly Regional Meeting, New York, Local Transport Workers Union, West Side Hotel, Astoria, N. Y.

**Aug.** 23-24-Conference on the Use of Electron Beam Glass, Glendale Springs, Calif. Sponsored by Solid State Electronics Laboratory, University of Illinois' Research Institute.

Aug 27-29-NIME Technical Conference on Advanced Electronic Materials by the Franklin Inst. Philadelphia Pa  
 Aug 27-Sept 1-The 1st International Congress Interatomic Council of the Astronomical Sciences, New Copper Hall, Stockholm, Sweden

Aug. 27-Sept. 1—Second International Congress International Federation of Information Processing Societies, Moscow  
Aug. 28-30—Fourth Conference on Manufacturability of Electronic Equipment, Electronic Industries Association in cooperation with Department of Defense, University of Colorado, Boulder, Colo.

Sept. 3-7—National Advanced Technology Management Conference, Institute of Radio Engineers, Santa Clara  
 Sept. 1-7—International Symposium on Innovation Theory, Institute of Radio Engineers, Brussels, Belgium  
 Sept. 8-10—FIBONACCI, Flanders Technical University, Ghent, Belgium

Sept. 4-7: National Advanced Technology Management Conference, Opry House, Seattle World's Fair grounds, Wash. Sponsored by University of Washington, professional engineering groups and technical society councils. Business Press.

*Thermal Radiation Properties of Solid Bismuth Oxide, Duran, Ohio Spacers Aeronautics Systems Division USAF, Naval Bureau of Standards, NASA*  
Capt. W. H. Klemm, Jr., Aerospace Research Institute, Aerodynamics Research Institute, Ohio Department of Aviation and Space Division, USAF, Columbus, Ohio, RESEARCH CENTER

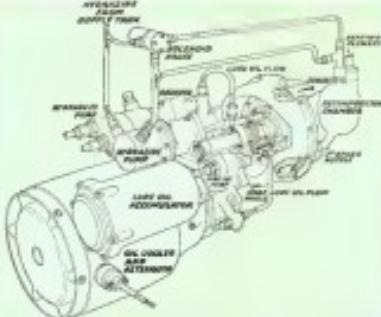
Sept. 14-Second Annual Convocation of  
Latin American Authors, Inc., Queen  
Elizabeth Hotel, Montreal, Canada.

Sept. 15-Held with National Conference on  
Applied Meteorology American Meteorological Society, Hampton, Va.

Sept. 18-Presented General Meeting, In  
International Art Teachers Assoc., Delco

Sept. 13-14—10th Annual Engineering Management Conference, IEEE, Hotel Roosevelt, New Orleans, La.  
Sept. 17—Shuttlecock & Air Cricket V. Badminton Meeting, Institute of the Aeronautical Sciences, Sherman Halls, Washington  
Sept. 18-29—Indiana Environmental Research Institute, Bloomington, Ind.

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## AEROSPACE CALENDAR

(Continued from page 7)

the Chief of Ordinance, Armstrong Int'l. Services Research Institute, Sept. 15-20—National Aerospace Education Program, Personnel Av. Force Vect. Lab., Vega, Nev.

Sept. 19-20—Technical Meeting, Institute of the Aerospace Sciences, Hotel Commodore, New York.

Sept. 19-20—Operations & Maintenance Seminar, Lockheed Corp., Valley Stream, N.Y.

Sept. 19-22—Sixth National Conference on Total Technology, Monroe Union Auditorium, New York, N.Y. Sponsored by American Congress on Total Technology.

Sept. 19-20—Aerospace Institute of America Annual Meeting, Hotel Statler, Atlanta, Ga.

Sept. 19-20—Aerospace Institute of America Annual Meeting, Hotel Statler, Atlanta, Ga.

Sept. 24-26—12th International Air Transport Conference, Conference Ave. Mt. San Hotel, Chichago, Ill.

Sept. 25-27—Third Annual Symposium on Reliability, Drexel Inst. of Tech., Philadelphia, Pa. Sponsored by Materials Control Div. of Oak Ridge National Laboratory.

Sept. 27-28—9th Pacific Seaboard Congress, American Society of Safety Engineers, Hyatt Regency Hotel, San Francisco, Calif.

Sept. 26-27—Symposium on the Physics of Lasers in Electronics, Illinois Institute of Technology, Chicago, Ill. Sponsored by Army Materiel Development Center, USAMRMC, Commanded by Army Research Foundation.

Sept. 26-Oct. 2-1962 General Conference Federation Acoustics, Internationale Akademie, Graz, Austria.

Sept. 26-29—Society of Experimental Test Pilots, Sixth Annual Awards Banquet, Hotel Roosevelt, Calif., Calif.

Oct. 13—Seventh Annual Expansion & Symposium, Art Traffic Control Assoc., Flamingo Hotel, Las Vegas, Nev.

Oct. 2-4—Third Symposium on Advanced Propulsion, University of California, Calif., Calif. Institute of Technology, Pasadena, Calif.

Oct. 2-4—National Symposium on Space Structures and Techniques (RF), International Hotel, Miami Beach, Fla.

Oct. 2-6-10—World Yachting and Competition, National Business Unit, Los Angeles, Calif. Sponsored by Plywood, Inc.

Oct. 8-12—National Aerospace & Space Engineering & Manufacturing Meeting, Douglas Society of Automotive Engineers, Las Vegas, Calif.

Oct. 8-13—National Space Institute, American Assoc. of Space Engineers, University of Colorado, Boulder, Colo.

Oct. 10-11—Space & Rocket Exposition, Conference Auditorium, Rockford, Ill.

Oct. 12-13—National Space Institute, Palm Springs, Calif.

Oct. 15-17—1962 Meeting, Southwest High School Mfg. Sports Institute of the Aerospace Industries, San Antonio, Tex.

Oct. 15-19—International Symposium on Space Phenomena and Microgravity, State Hibon, Desert Melia, Saudi Arab.

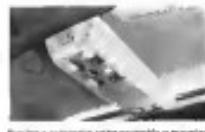
Oct. 16-19—Meeting, Institute of Radio Engineers, co-sponsored by NASA and IEEE.



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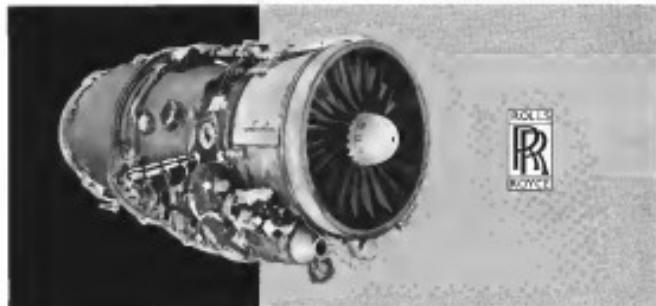
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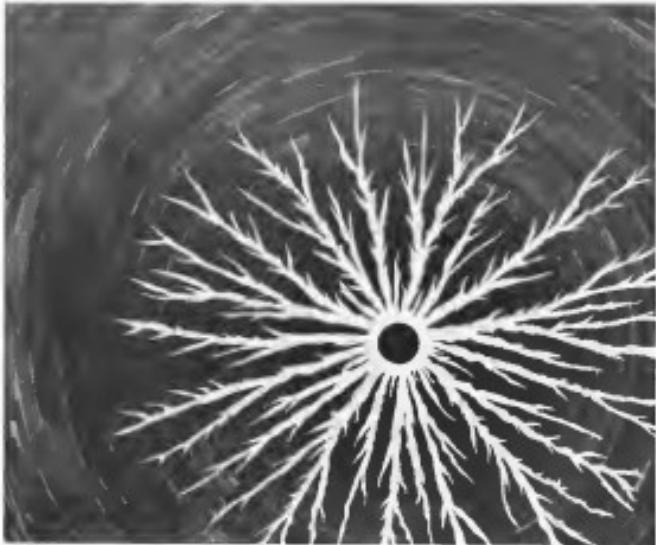
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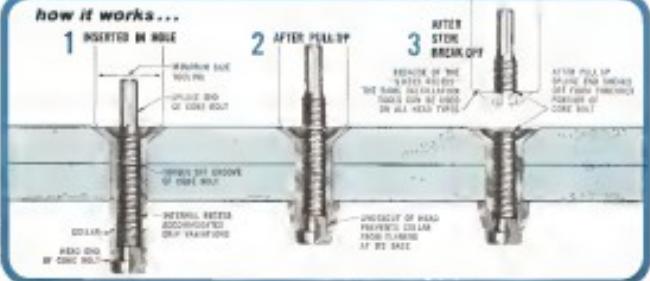
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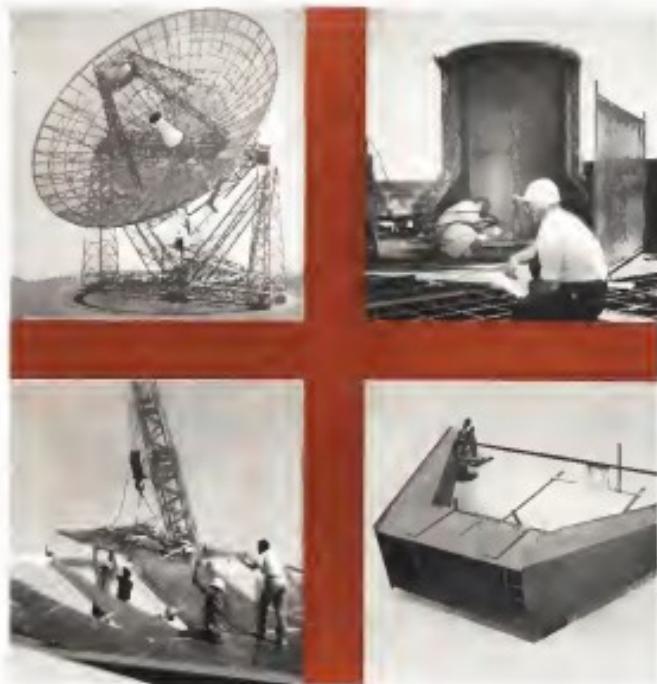
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# EDITORIAL

## Plea for Simplicity

(Benjamin McMillan, assistant secretary of the Air Force for research and development recently issued a plea for a return to simplicity in the design of aerospace hardware. At issue was a publishing significant exception from rule before the Sixth National Conference on Manned Electronics, in which McMillan suggested ways that industry and government can avoid some of the complexities of hardware design that lead to unreliability in aircraft, missiles and space vehicles.)

I note with alarm—the combined notion that the best design is the one with the most additional, unimportant functions and greatest growth potential—growth in most instances being vague and undefined [also] signs of less and less original creative thinking—and more reliance upon fulfilling government requirements by means of “fat” government research and development contracts. We are in very real danger of this trend continuing. The great source of our strength has been the enterprise, the imagination and the drive of our American industry. Are we losing this drive because government research and development contracts are available? Are we forgetting our heritage because it is easier to let government specifications do our thinking for us?

The matter of government specifications brings up a related subject: A great deal of discussion has transpired concerning the awarding incentive contracts. These have been arguments pros and cons and a lot can be said for both sides. Time does not permit me to engage in such a discussion now. Clearly connected to my plea for simplicity, however, is a different type of incentive now being considered. Many of our specifications for research and development are quite detailed. Often they specify complicated equipment, or fail to recognize that there may be simple and less elegant ways to solve the problem.

### Incentive for Originality

We are considering a greater use of performance specification. A detailed specification, or a typical design would accompany the performance specification in order to clarify the intent. The request for quotation would make it clear that the typical design is not particularly the desired design, that the contractor is encouraged to use his ingenuity and good sound engineering judgment to reduce cost and complexity and that in the bid evaluation process a large bonus would be given to contractors who display originality in simplification and cost reduction. I have a feeling that you may see some of this type

of incentive contracting in the near future—at least from the Air Force.

Closely allied to completeness of engineering is our realistic appraisal of the growth of technology. This may mean conservatism, but I will be able to touch on only a few.

One of these is our almost utter disregard for the fundamental laws of reliability. The probability of failure of equipment rises somewhat directly with the number of components. Doubling the mean time to failure of a component approximately halves the doubling of the number of components. Yet, doubling the mean time to failure of a component is hard to achieve—doubling the number of components we do almost in our sleep—so naturally and frequently does it occur. Solid state devices make a quantum price-reliability ratio that is—the reliability of individual components, but the added number of components negates the advantage completely. Please assume the system reliability equation.

### Conventional Weapons Need

Another myth of our technology relates to space vehicles. We have become enamored of space vehicle technology and have channeled much of our efforts and energies in this direction. Certainly we are going more and more into space efforts. Certainly space vehicles are going to be important adjuncts to military resources. In many instances existing military missions can be best accomplished only by space vehicles, but the need for technological improvement of conventional weapons is a legitimate pressing need and still an unfinished need.

Some years ago, it was thought that all our weapons were going to face a radical change. Missiles and space vehicles according to that view would dominate the armament in war. Pilots would reduce the importance of the conventional Navy, and the newer weapons would exile the fleet soldier of old. About ten years ago, it became obvious that the conventional tactics were drawing difficult battle lines in Southeast Asia, in Africa and even in the longshore. These limited warfare conventional tactics require the Army, Navy and Air Force in conventional form. A growth, and a decline in non-nuclear weapons is required for this situation.

What I have said and have said at different times to others were eloquently and forcefully than I can now state it. Let's return to reality. Let's return once more to the conventional soldier. The conventional soldier mobile, the conventional material for the foot soldier and the conventional airplane, is a simple, reliable way

## RUSH Hercules fire birds!

When disaster threatens, the call goes out for the Lockheed C-130 Hercules. TAC's C-130s airlift men, matériel, medicine to distant lands to help homeless or hungry people—or put out brushfire wars before they spread. Hercules is also ideally suited for Civil Defense work. The big prop-jets are made to order for airlifting and paratropping Civil Defense supplies to emergency centers. And, in peacetime, those same giant workhorse airplanes could be kept busy fighting forest fires, floods, hurricanes, and other disasters.



**LOCKHEED-GEORGIA COMPANY**  
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The NASA Langley tracking antenna at Aransas Rock, Virginia, uses Texas Instruments broad beamwave parametric amplifiers.

## Hearing better with TI paramps!

Many microwave communications and radar systems now incorporate parametric amplifiers and low-noise receiver assemblies from Texas Instruments. From L band through Ku band, standard and custom equipments operate efficiently and dependably in monopulse radar, polarization diversity tracking,

troposcatter communication, and other airborne and ground applications. ■ Texas Instruments staff of experienced application specialists will help you analyze your systems requirement. Call today. ■ Also See *Texas Instruments Career Opportunities*. Advertisement in this issue on Page 126.



**TEXAS INSTRUMENTS**  
INCORPORATED  
FOOD LEMMON AVENUE  
FORT WORTH, TEXAS

## WHO'S WHERE

### In the Front Office

Charles E. Barr, president, John Gutfreund Manufacturing Co., Newark, Delaware. In view: Vice president, Robert Ober, re-signed.

Bernard E. Brown, manager of Douglas Aircraft Co., has resigned to work as a vice president in another organization. A. V. Edwards, July 30, p. 13, assumes the job of Brown.

Frank W. Loffing, president, McCroskey-Silph Associates, Halfway, Calif.

Vernon B. Snyder, president and a director of Verneon Inc., and his wife, Dorothy Rose, and William H. Thompson, Jr., resign.

Dr. Lester T. Mohr, president, Douglas Defense Systems, Farming City, New York. Dr. Alvin F. Pashak, vice president of Hughes Aircraft Co. and head of the research & engineering group, has been appointed vice chairman of the Hughes Space and Communications Group. Dr. Pashak is also a member of NASA's executive committee.

John G. Ploofmark, a vice president of Arconetics, a division of North American Aviation Inc., in charge of the Division's Communications Division, El Segundo, Calif. Robert E. Baumgartner, president, working for IBM Storage Jar, Staten College, Pa., and Charles W. Diers, vice president, announced firing.

Robert F. Bushell, president, Ladd Co., a division of Durst Optical Corp., New York, N.Y., has joined Wilmot B. Nutall and was elected president of Cineo Corp.

Robert J. Mazzoni, vice president/marketing, General Precision Inc., subsidiary of General Precision Equipment Corp. Louis P. Anderson, vice president/computer sales, and Jim L. Endreson, vice president, sales, Research Resources Corp., Stamford, Conn.

Robert F. Schatz, president and general manager, Ingersoll-Rand Division of the Wards Corp., Rahway, N.J., was installed. James D. Ingersoll, former head of the division, was promoted to V.P. of Strategic Planning.

Robert L. Nichols, vice president, Haug Industries Inc., Whitehouse, Ohio, responsible for all product design engineering and sales, has joined the company.

John S. Cheeseman, vice president, marketing, DME Inc., Fort Lauderdale, Fla.

Frederick M. Ossia, vice president, business development, Inc., New York, N.Y., responsible for research programs, technical process, material and service product issues.

Melvin P. O'Neill, vice president/marketing, and Tom J. O'Neill, vice president/engineering, M. P. O'Neill Inc., San Francisco, Calif. Edward W. Neff, vice president/marketing, and management, Foster-Miller, and John A. Miller, director of flight operations and flight analysis.

Bernard E. Lippman, president/marketing, Computer Information Corp., a Sonoma, Calif., subsidiary of the Data General Corp., Norwalk, Conn., has joined the corporation. Sam Lippman, a subsidiary of United Aircraft Corp., and Arnold W. Wolff, treasurer, also William H. Murphy, venture capital for Skidmore College Fund, resign.

(Continued on page 134)

## INDUSTRY OBSERVER

► Air Force is asking engine manufacturers to propose direct lift turbogear engines in the 4,000- to 9,000-lb thrust category for a feasibility development program intended solely to advance engine technology. This marks a departure from USAF's weapons system concept which has required all development work to be part of an overall system designed to meet a specific operational requirement.

► Development program for a 116-in-dia. solid-propellant rocket motor with a 30-in. diameter core has been suspended by National Aerospace and Space Administration. USAF was reported still interested in the 116-in. core, but opposed to NASA's development of it. ANF June 16, p. 32. Proposals were submitted by seven of the 29 companies invited to bid by NASA's Marshall Space Flight Center.

► North American Aviation hopes to make the first flight with the XSTB prototype before the end of this year, possibly in late December. The Mach 1.6 transonic-climb aircraft, being assembled in NASA/USAF Plant 42 at Palmdale, Calif., has been removed from assembly rigs and placed on its own landing gear at the hangar area. First flight, planned in about two days of two tests, will be made from Edwards AFB and placed on its own landing gear at the hangar area. First flight, planned in about two days of two tests, will be made from Edwards AFB. First landing and subsequent flights are intended to be made from Edwards AFB.

► Requests for industry proposals for low-altitude and cruise-thrust-offer environmental testbeds in Department of Defense's remastered Project Arrow are expected to be issued by early September. Current thinking is that proposals will call for single testbeds for both aerospace and ground transportation systems by each type of user.

► Mariner M, long-awaited second Mars orbiter spacecraft intended for May 1980 (ANF July 16, p. 82), is currently en route to Mars. Mariner B is en route for Mars 1984. Mars exploration is not needed because of delays in Mars-Center, the scheduled Mariner B booster. Mariner M will be light enough to be launched by an Atlas-Agena B rocket.

► An Atlas has chosen interest in retrofitting Alliant T56 turboprop engines to some of the approximately 700 Fairchild C-119 troop carrier transports to active reserve inventory. Conversion could make the transport more attractive to military in the U.S. military assistance programs.

► Contractor selection process for Jet Propulsion Laboratory's planned 21-kW electric power module, including software, of the Deep Space Instrumentation Facility at Goldstone, Calif., was to have been completed with an initial baseline. Multi-function data bus will be the first of three to be incorporated into the facility and will extend its scientific tracking capability. 80-km-Km. An completed in one-on-one study of the antenna last week and JPL staff will select a construction contractor from among units in Blue Ridge, Hughes, Raytheon, Rohr Aircraft located by Shreveport, Hensel and Sons, Reid.

► Helio-Aircraft Corp. and Eastfield Systems Corp. are attempting joint marketing of light STOL aircraft including the single-engine Helio Courier (USAF L-100) and the twin-engine Helio H-100 (USAF U-3). Federal Aviation Agency type certification program for the H-100 is near completion.

► Startup soft-landing lunar spacecraft being developed by NASA's Jet Propulsion Laboratory will not use Earth's gravity assist maneuver to shorten the trip to the Moon. JPL made the decision after considering various boost options to Centaur including the addition of booster rockets to either the Atlas-Agena B or an undischarged Centaur stage.

► De Havilland Aircraft is continuing to study development of the Gracel Electric G970 off-the-engine for possible application to its DH-104 jet executive transport. Company has considered installation of the G970 engine in aircraft U.S. based, but would prefer the more powerful engine and corresponding performance gains. First two DH-104s have been sold to British Subdelta Engines, a division of the aircraft's parent, Vickers-SIDC propellers, and an unassisted West German industrial company.

## Washington Roundup

### Orbiting Space Stations

Orbiting manned space stations are getting increasing attention—and strong user endorsement—by National Aeronautics and Space Administration and the Air Force. Cost is an extremely potent factor in the debate over the need for keeping the space station alive. Some analysts in both agencies question whether the agency will support such a project even after the costs of Project Apollo begin to move off state cost from now. Others feel the work should move immediately toward the research studies and early conceptual development now, giving up

NASA's hold-a-round meeting at its Langley Research Center last week on space station technology, according to sources from other interagency agencies.

The Air Force feels NASA is neglecting space stations in favor of Apollo. It would like to see a permanent station established first in a smaller International Laboratory and then moved into a 70-man permanent orbital control station. NASA considers the USAF position as being USAF should move later on Aerospace Plane. Some kind of recoverable booster is almost essential if reusable cost is to be reduced and USAF sees Aerospace Plane as a potential revenue item. It has no appeal to helping develop either Aerospace Plane or a station.

### A Double-Slotted Flap

Air Force is having its problems on paper and in the sky. The Hirsch board, which has been studying unconventional approaches to lift-off vehicles, IWW June 25, p. 281, has alarmed Defense Secretary Robert McNamara with its non-conventional ideas of using more than 100 aircraft from all over the country to accomplish its recommendations of Dr. Brueg. Per dozen other costs have soared and the study has broadened to encompass future weapon systems.

McNamara went to Dr. Brueg July 25, with an F-4C Strategic Budget Nuclear in the game for a maximum performance of air mobility. In spite of a perfect short refueling the show still won less than a success. Army considers that a Bell UH-1A helicopter landing and launching the entire system in low altitude flight but that both failed safely, due another helicopter had a gearbox failure which kept it from flying off. It does report that another UH-1 was crushed from the ground up and that a Grumman AG-1 Mohawk was damaged. One helicopter traded a 10-ton load, however, because of emergency set rights, with its shot coming past the ground.

### Support for Nike-Zeus

Watch for Air Force to support Army's development of the Nike-Zeus anti-aircraft missile. Some USAF leaders are ready to argue that it is a promising anti-ballistic missile. Dr. Harold Brown, defense director of research and engineering, still emphasizes that the Nike-Zeus is far from proved and Charles Hatch, defense manager, will urge that the system is an offensive, would cost from \$1 to \$1.5 billion depending on range and extent of deployment.

Army's Grumman AD-10 Mohawk will be the next aircraft type to make its appearance, 2 Sept. Vietnam. It will be dropped of instrumentation gear and fitted for conventional 2-stage version. Army plans will be to fly the Interceptor STOL and South Vietnamese pilots are considered qualified. More than 100 surplus USAF North America T-28s Interceptor jets were later converted to T-28Ds by NAVFAC California. By now in use in Vietnam. This includes substitution of the more powerful Wright R-1820-96 engine for the Wright R-1820-13, and provision for carrying conventional armament. Some surplus Navy T-28s, which should have the larger engine also being modified. T-28s have been in use in Vietnam for a number of months.

### More TFX Changes

Rising and the General Dynamics-Gulfstream team have made extensive management changes in response to Defense Department's instructions to each to review its cost with the T-11A tactical fighter (TFX) competition. They are not agreeing, although they can't say exactly why. The original competition was seen as an "at least" effort, and one contractor compared the situation to trying to keep a fishbowl from "tip" for first goes in a row. Most of the changes go toward at propulsive, generated and divisional in the Pratt & Whitney cells re-engineering them for a specific job. This will save some development time since a winter is peaking, but this won't be much of a plus since a new spent fuel rod estimate uses the requires for proposed first flight not. The contractor could, however, that Air Force and Navy probably will get much better aircraft than they would have if they had bought the design presented early this year.

House space subcommittee hearings on solid rockets this week are designed to obtain the Administrator's blueprint for development, rather than to rebuff the solid as bad arguments. Chairman David King of Calif. and Sen. Woods, the hearings delayed enough to review both Defense Department and NASA in a delicate place of whom. These also will be considerable discussion of fiber glass cores, using Hercules Powder's work as an example.

—Washington Staff



### ... out of 22 years of ASW fire control system engineering

This is the ASROC fire control computer, symbolically effort. In reality, this computer directs the fire of the U.S. Navy's antisubmarine rocket weapon system. It is the latest of eleven major Librascope contributions to ASW dating back to 1940. More than 80% of the



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# Wiesner Warns of Private Research Lag

By Katherine Johnson

Washington—Concern is developing within the Kennedy Administration over signs that the country's basic contributions to military research and its testing effort, as the private research arm of the U.S. Government, are in decline.

The Director, B. Wiesner, director of the newly-established Office of Science and Technology, emphasized last week that military research is "proving quite research out of existence," in terms of the defense military operations being conducted by the Defense Department (AW, July 12).

Because of the ease of getting defense contracts and the lack of safety of leased, private enterprises in turning over existing in-house funds to civilian research, Wiesner reported.

He said, "we begin to see signs of serious trouble" if U.S. firms cannot compete with overseas firms maintaining a balance more favorable to research in the civilian commercial sector.

The divergence between military and civilian research is steadily increasing and the impact of military research on commercial development is growing fast and low, Wiesner told the subcommittee. An airframe designer noted that the B-52 strategic bomber was a major contribution to the Boeing 707 long-range transport, but that the Atlas intercontinental ballistic missile had made little contribution to commercial aircraft. He added the communications satellite is a notable exception to this.

general need. Wiesner also said that as general areas such as weapons improvements, military research will continue to make valuable contributions to the civilian sector.

Wiesner emphasized to the subcommittee that civilian research must have first priority and that he was not recommending less money for it. "But we must be aware of what is declining," he said.

The subcommittee is conducting a series of hearings on weapons system management, including the commissioning of the report to the President on scientific and technical policy drawn up by inter-departmental committees headed by David E. Bell, director of Budget Bureau (AW, June 7, p. 5).

Earlier representatives of two key weapons organizations guiding Defense Department policies on weapons systems are continuing to expand on their programs:

- Institute of Defense Analysis. Robert M. Ballou, former director of operations for Central Intelligence Agency who became president of IDA, July 10, asserted that the firm anticipated a billion-dollar volume of business from Defense Department for its test starting next February. IDA was founded in 1958 at a \$100,000 grant from Ford Foundation. In its technical advice to Weapons System Evaluation Group, functioning under the Joint Chiefs,

We have been able to do a great deal more than we can with our present staff," Ballou told the subcommittee. "We are selecting low-grade personnel."

Two presidential advisory groups will share these findings and recommendations to the President through the new office. These are:

- President's Science Advisor Council

too, composed of 15 eminent scientists and engineers, which would advise the President on science and technology in its own initiative. Wiesner will continue as chairman of the committee and as special advisor to the President for science/technology.

- Federal Council for Science and Technology, comprised of top-level representatives from eight government agencies, including Defense Department, Atomic Energy Commission, National Aeronautics and Space Administration, and National Science Foundation.

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Under a new reporting plan, IDA's technical evaluations for weapon selection will go directly to the secretary of defense and the Joint Chiefs of Staff, as well as to WSEC. Some military leaders have voiced fear that as consolidating weapon selection with the secretary of defense, with IDA as chief advisor, Ballou stressed the need for "clear military competition" and said that the appropriate weapon leaders were scaling "more than ever" into the new reporting plan.

Dr. Donald Rumsen, director of defense research and engineering, took the same view. He and a Defense Department staff memorandum July 31 was sent to bring WSEC and its contractors into conformity with the recommendations made in the several Budget Bureau reports on contracting procedures. It also told a House armed services committee, representing Defense agencies that there was no intention to bypass WSEC. He said the agency would be consulted but not superseded.

Rumsen also asserted that IDA has organized a division on weapons studies to focus on general nuclear.

- Logistics Management Institute. Organized last October, LMI has proposed a \$1 million fiscal 1961 budget to ad-

vise the secretary of defense on a broad spectrum of procurement problems. Headed by John Shultz at \$53,000 a year, president, LMI has a small professional staff of 14 and will hire herein on contract basis. Shultz was formerly general of Houston Peacock Corp., a small West Coast electronics company, and served as director of logistics of material at Hughes Aircraft.

Shultz told the subcommittee that recommendations by LMI on the broadest of aerospace space parts for acquisition procurement have produced lower prices totaling over \$10 million.

LMI's major projects in the coming year are directed toward development of baseline and excess specification and standards; reduction of inventories and costs; mechanical and electrical design; design for manufacture; development of methods of controlling engineering and design changes in special development; and production increased competition in the procurement of production quantities of the most important weapons; evaluation of new possibilities for cost and performance reduction; development of criteria for establishing the profit of fixed price contractor on cost contract; elimination of unnecessary reporting requirements in defense contracts.

## Equation Error Cited In Mariner 1 Failure

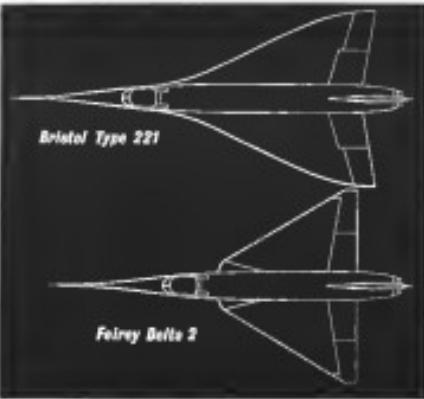
Failure of the Mariner booster to follow the desired trajectory in the attempt to launch the Mariner spacecraft on a Venus flyby mission July 22 was due to a shortcoming in the guidance equations of the NASA's National Space Administration and flight control centering Avco Worcester, Mass. (AW, July 10, p. 5).

The guidance equations, while functioning correctly, did not take into account the Earth's oblateness, which causes the planet to bulge at the equator. This error caused the Mariner 1 rocket to miss the Venus flyby by 100,000 miles.

The basic difference occurred in the equation used to calculate the longitude position and is believed to have come from the Gemini/Mercury portion of the program, which was developed before the Mariner program. Changes are being made to prevent a recurrence of the errors in Mariner 2. French experts scheduled for delivery after the middle of the month.

At Dr. McMurtry's guidance meeting on May 26, Mariner 2 turned that had been modified for a single-pole陀螺仪. It was powered by a 280-lb engine and had a weight bypass and fairing-control ring and tail surfaces. Hungarian Czech and Polish pilots and a light, soft seat, called Zem. The American U.S. team, which included the three pilots, the craft's two technicians and a member of the international judging panel, was sponsored by the National Aerospace Association and the National Aviation Club.

When the names the basins are punched open into a pitch memory



British Reveal Fairey Delta 2 Configuration

First official drawing of the modified Fairey Delta 2 which will be used in the British supersonic transport research shows extensive changes in the winglets, wings, tail and in the Bristol Type 221 configuration. The type 221 is generally described as a configuration of the Fairey Delta 2 aircraft with a larger, more powerful engine, a revised airframe, and a different tail section. The Fairey Delta 2 will be modified with this obtained by flight tests of the Hawker Siddeley HF 111 aircraft. The configuration may have speed characteristics (AW, Aug. 25, 1961, p. 5). Tests will also be taken from the Fairey Type 221 stability shift around deflection of the elevators of Mach 2 regions (AW, July 10, 1961). Refurbish of the Fairey Delta 2 includes new tools for the Rolls-Royce Avon RA.288 turbojet engine, addition of 6 ft to the fuselage to accommodate the new wing and additional fuel tankage, and a new landing gear. First flight will be in the summer of 1963.

and J. Hukla and V. Bruck of Czechoslovakia was also vice-chair and fourth member.

Premier of France, Mr. J. De Gaulle, signed a modified Concorde license plates that was designed in 1953 and built in 1952. It was powered by a 375-lb. Wright engine. Andrew J. Justice of Gifford, Pa., the 1956 American World Aerobatic pilot, played 1961 and Dutch Captain of Pil. Wimme Jel, a professional aerobatic pilot, played 20th. Carl Frisch of Austria, Helmut Kroll of West Germany, and Georges de la Roche of France, played 1970.

The first French team, which used a modified FA.15 World War II fighter that had been modified for a single-pole陀螺仪. It was powered by a 280-lb engine and had a weight bypass and fairing-control ring and tail surfaces. Hungarian Czech and Polish pilots and a light, soft seat, called Zem.

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## Schriever Says Over-Optimism Hurt Midas

Washington—Midas risk-warning studies are an example of progress the Post-graduate instrumented optimum—pushed too rapidly and developed with the result it had to be renamed. So General A. Schriever, commander of the Air Force Systems Command, told the House Armed Services subcommittee last week (p. 26).

The over-optimism "in the part of the Air Force and the Pentagon" he said, was in two areas: the reliability that could be expected from computers and in the technical lessons.

He noted that Air Force worked with Defense Department on the instrumented and reported that "there is no question as to the technical feasibility of the system, but it will take longer to develop than initially forecast."

Gen. Schriever also told the subcommittee that he hoped contractors would soon be let with industry for several new weapon systems still in the paper phase (AW, July 30, p. 36).

"From what I feel, I think we could move faster," he commented. "We have not initiated a new systems program for some time—over a year. We have several under consideration, as the defense phase. We are defining it to a higher degree than in the past.... It is a matter of judgment how far one can go on paper.... There are some programs that have the rest." He hopes we will get them going soon with firms of selected contractors.

He said that cost effectiveness was a factor, but not the overriding one, in holding up the new systems.

Rep. Bradford Moore (R, Mass.) suggested that the situation might be called "the initiative gap" in the Pentagon.

# NASA Launches Second Balloon To Study Effects of Cosmic Rays

By Russell Hawkes

Second in a series of four planned high-altitude balloon flights being conducted by National Aeronautics and Space Administration Ames Research Center, Calif., to study the effects of cosmic rays on atomic and other biological processes, was successfully launched last week from Goose Bay, Labrador.

Long spherical plastic capsules containing specimens and instruments were used, as well as a control and communication gondola. Osgood's fan supply is also planned for each balloon, but weight limitations forced elimination of use and duration of its payload among the other two.

Mishandled and weather problems and bad delivery of experimental capsules have sped launching schedules. First launch in the series was made with only three capsules and the two thermal insulation and fuel tanks; but were the space capsule and its thermal insulation added and an instrument is missing, blood flow through the walls.

## Payload Arrangement

The payload in the 76-spherical capsules is arranged in a circle around a central frame and suspended in a net from the level line of the balloon. The control and communication gondola hangs beneath the frame where ejection guns, coarse guidance, coarse motion sensors, particles into the capsule and combine the experimental data.

This is no unknown of experimental data through Riken cameras have long been available for it to record. The tracking sensors in the gondola units with a spatial sequence of 90, 0.15

sec. Separate thermal insulation from five sections of the fan cooling and six for control, eight for the interior mesh and eight electrical shielded interior panels are suspended between the thermal insulation. A coarse and fine guidance system is used to position the gondola in relation to the ground or base. Fueling plan to extend altitude in increments of 10 sec.

The tracking plane at an Azimuth-Crossing over a proton monitor, a balloon navigator and two gages. Measurements planned to find the tracking plane to remain generally in continuous contact with the balloon. Close tracking is needed because some papers vibrates and the balloon is relatively a constant floating altitude of approximately 178,000 ft.

The tracking plane also command the balloon to drop ballast to gain height. Ejection is tested automatically if the balloon goes above its design altitude regardless of expansion of the envelope. The results.

A flight control is accurate to within two minutes.

If the flights are not completed by summer, the programming needs of the tests will continue and the mission will become impossible until next summer because of the changes of a winter landing off the East Coast.

Planned duration of each flight is about 55 hr. Because of the second capsule was expected Service Director, Soderstrom and Parkinson, Alberta.

The mission profile is planned to minimize time at middle altitude where frequent coarse secondary and after experimental subjects and early later interpretation of data more difficult.

## Strike Causes Drop in Republic Earnings

New York—Republic Aviation Corp. last week reported earnings of \$12 million on sales of \$104 million for the first six months of 1968, down 10 percent from a decline of 14,000 sets per month of each model's basic jet fighters caused by the impact of heavy rain on production.

\* Four hundred Avant aircraft plus 100 for delivery to foreign customers, delivered to defense and other sectors.

\* Your four hundred University of California scientists will work on the hedge to determine changes caused to cause private strikes. Bombers hedge was selected because they are more sensitive to vibration than aircraft.

\* Other industrial operations include Norwegian, a form of metal being examined by Florida State University, none will existent, rent, three dual gate bars and third were. Sales pattern an abnormal type developed during earlier analysis and subsequent tests will be carried to determine

whether certain radiation-caused genetic changes and whether the viruses can come on less violent.

\* New-borne experiments include a large balloon park for the University of California to study the physical characteristics of cosmic gamma rays.

For the National Research Council of Canada as part of a program to improve long-term balloon mission techniques, and a Geiger Counter stops to measure size and velocity of high-energy particles.

The physiological status of the monkeys is to be recorded continuously with a 14-channel tape recorder with a 20 hr recording file. The instruments used for this are an electroencephalograph, electro-carotograph, electromyograph which measures rate and depth of respiration, both temperature, heart sounds, and an instrument to measure blood flow through the aorta.

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# British May Cancel Blue Water Missile

By Herbert J. Colemen

London-British Defense Ministry last week was seriously considering abandonment of the British Blue Water intermediate-range missile as a nuclear weapon for British Army in favor of guided missiles.

Reasons to terminate Blue Water

are cost, obsolescence of warheads, and the need for a new generation of missiles.

\* Blue Water is part of a series of range defense missiles are:

+ This IRBM has phase out. In view

of a new program in Aviation

Ways (AW) File 76, p. 36).

+ Avon Blue Steel stand-off bomb re-

view.

+ Hunter Sidewinder stand-off mis-

sile stand-off missile and possibly

elimination of the Mk. 2 version under de-

velopment?

The Blue Water name is specified by the Ministry of Defense, Prime Minister, minister of defense, a surname in the AW, and the name of the Royal Air Force, the prime contractor.

Also mentioned is a new missile

agreement between BAC and the French government not completed.

Lots is a secret with Naval Aviation to plan with the French on research

## Gemini Landing Site

NASA is considering the use of one of probably three locations in the United States, Australia, and Canada. China, Tex., for landing the transonic Gemini spacecraft after its return from space following the first prolonged orbital flight.

Forward landing speed should not exceed 60 to 99 ft. per sec. for ground which would be equipped with Rapide type wing and slab. The projected profile, which is expected to include roll right up to 14 deg, will explain feasibility of techniques for reentry and for use of the astronauts to leave the spacecraft and return to it.

Rearward rotation will be considered with an Agave generally faster into the ground by an Agave. Orbital maneuvering and landing maneuver for reentry will be held by hand held or both Gemini and Agave. Under ideal operational conditions it would be desirable to have sufficient fuel reserves to make some contingencies.

Initial plans difference between the two spacecraft is not expected to exceed 40 deg. in orbit. Minimum phase difference could not exceed 150 sec. in the direction of rotation without causing fuel consumption which would deplete the supply before rendezvous could be achieved.

Similar basic was used when the P-637 surface-to-air missile was developed. The basic idea is to reduce the number of targets which employ two or three guns. Although the two-boat solution proposed as a means to reduce the likelihood of being hit during the boat phase

ended in frustration before the problem started. Select Committee on Environment, Mr. Gen. A. P. W. Hodge recommended against policies for the Miss. Office to avoid a what stage the Miss. Office would be at when it dropped or limited growth.

\* Sidewinder, a project not dropped or limited growth and is itself but in the context of a general review of research and development expenditure, especially in the case of the AW.

"I do not think, anyone doubts that this potential weapon would be a good one but when it come to be selected in the defense budget is a whole different and in the research and development part of it is potential. I think the defense committee took the view that something had to go and, unfortunately for the AW, FT 452 was selected. So far the Miss. Office has done well. In its early days it was not just in its early days at a project, but early, surviving the program as a whole."

Other non-published discussions include a long range version of Blue Steel and addition review of the British Benthorn. Benthorn. Also some will continue to be changed to the Spanish launches which still so far as the European launcher developing organization continues to have success and these funds should have been spent last.

The 12 TTS had started in 1969 Naval Air Force personnel, cost about \$200 million alone. The US share count of the cost of the 60 TTS would, however,

## Missil. B Awards

Are you a commercial adopter of three companies—Orville, General Electric, and Lear-Jones-Vanguard for award of trials contracts to test their Marlin small aircraft launch system? Marlin

\* All three companies were given these awards to test their anti-Miss. guidance techniques while none of the firms received financial guidance was offered. Defense Department was concerned that these contracts do not affect the other three anti-Miss. guidance systems.

The anti-Miss. technique can render useless to detect the drift and drift of the missile after initial target plane starting the losses in regard to the accuracy desired targets. Unlike an inertial system which employs two or three guns, the two-boat solution requires as good, although of course more resources proposed as a means to reduce the likelihood of being hit during the boat phase

# GOP Campaign to Cite Aerospace Issues

By George C. Wilson

Washington—Republican party will try to build a campaign issue between now and November on the charge that the Kennedy Administration is shirking its responsibilities in the aerospace field, especially by placing too little emphasis on the aerospace industry and the nation's space role.

Sen. Barry Goldwater (R-Ariz.) and Rep. Bill Wilson (R-Calif.), chairman of the Republican congressional and congressional campaign committee, believe that the aerospace policy administration will be most vulnerable September 15, the last date to file the aerospace budget, and the second to submit space policies.

Sen. Goldwater and Rep. Wilson told AVIATION WEEK that the party feels there is enough public concern about the Administration's aerospace policies to make them campaign issues. One slogan will be to blame the Adminstration for inattention or neglect and inactive plans.

To play like Long Island in front of the congressional and news media says this will not work, Rep. Wilson said. Sen. Goldwater encouraged the two congressmen to work to encourage that "it will be difficult" to reduce it into a campaign issue.

The Republicans plan to raise an Adminstration aerospace and aerospace concern of willfulness aerospace apathy. It will be granted various technical topics to audience from a panel viewpoint.

"We want them to tell us what's being done right and what is being done wrong," Rep. Wilson said. The congressmen will have the basis for their campaign statements.

Each expert aerospace source is to

## Indians Study MiG-21

India's defense ministry in New Delhi sent six to study MiG-21s some fighters and discuss the possible purchase of two squadrons of MiG-21s—20 aircraft in all—as far as its basic merits to air force chiefs.

The delegation, including a Defense Ministry source who is a force officer, two pilots and representatives of the Hindustan Aircraft factory, will also review the structure of the MiG-21 to be built in the Hindustan factory (AVW July 25, p. 14). In addition, the Indians' studies of potential to Russia to buy Indian pilots and maintenance crews previously accustomed to British aircraft will be studied.

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Wilson and others have been in demand about going before Congress a persistent position on the committee. Rep. Wilson said the advocacy committee will consist of no more than 20 people, and 10 already have been selected. No names have been mentioned.

Although the aerospace transport and missile arms will be the first topics, Rep. Wilson said the advocacy committee will also be asked to write in with a paper on Administration policies on development of space geopolitics, on developing and on availability "With a view to possible areas of weakness." It said.

Asked whether the Republicans could blame President Kennedy for not pursuing the aerospace budget cognizant enough when the Congress has cut the funds he requested for development, Rep. Wilson said: "That's the Pastoor. He sets the rules. The fact that he's inclined to spend funds for the R&D has had a disastrous effect on aerospace program development. The Budget Bureau word is good at urgent of research."

Rep. Wilson said the chairman of the House Science and Astronautics Committee has a long record on the military space issues which he deserved. I think it is fair, in the Defense Department to nominate and let the committee they do have a definite interest and a position [in space] which then have not been voiced in the public.

I am perturbed that the department does not care and say that we do have a definite written need in the field, because it is there and they have it."

## Ama-IB Launch

Avon's 315lb. motorized payload satellite under Navy management, is scheduled to be launched from Cape Canaveral on Aug. 16. Satellite weight and orbital parameters will be similar to those proposed for the Ama-1 (AVW May 12, p. 10), which failed to achieve orbit because around stage 38 the engine quit and became

uncontrollable. See "Ama-IB Launch" on page 11. Avon's 315lb. motorized payload under Navy management is expected to be launched from Cape Canaveral on Aug. 16. Satellite weight and orbital parameters will be similar to those proposed for the Ama-1 (AVW May 12, p. 10), which failed to achieve orbit because around stage 38 the engine quit and became uncontrollable. See "Ama-IB Launch" on page 11.

Fairchild will be located next orbit in an Avro Arrow. That first stage and Space General Aerobatic second stage, will still burn initially for approximately 20 sec., then enter for a little over 20 min., restart and burn for 14 min. until air intake injection.

Fairchild developed by John Hopkins Applied Physics Laboratory, will include Star-Doppler system, Avro Arrow optical beacon and Avro ultrareflector train package.

We cannot afford to repeat the errors made after World War 2 when a

large number of aircraft were

AVIATION WEEK AND SPACE TECHNOLOGY, August 6, 1968

Av. First, leaders in government talk with aviation and aerospace firms have been stressing the necessity that the United States develop a lead in the space industry. But President Kennedy in his first term the point that the current NASA budget was, should continue.

The one point is that Sen. Goldwater spared Edward C. Welsh, then-supported executive director of the National Aerospace and Space Council, to continue the Republican argument that President Kennedy should delay the military's space till the council has been working on a revision of national space policy that would have clarified this question for the President even earlier. It was suggested many reports that the various planning groups favored a longer space program (AVW July 18, p. 11).

The Republicans' campaign can prompt the Administration to concentrate on the military side now without writing a complete new policy statement.

The remained and control studies will be revised though by negotiation. At the Hughes Aircraft Co. and the Martin Co. in association with Schenck Electronics Products Inc., Fairchild is the integrator and subcontractor to the Hughes Aircraft Co. and North American.

In the second section, the choice to become Associate Division of Ford Motor Co. will be made with the Lockheed Systems Corp. and the Avco Corp's Research and Advanced Technology Division.

Roselawn Division of North American Aviation Inc. and the Roselawn Operations Division of Thordel Chemical Co. will compete for the propulsion studies.

Associated Machine and Foundry Co., Greenwich, Conn., Division and Canadian Aircraft Corp. v. Allis-Chalmers are contenders to study the transports launcher.

It was estimated that the MMRBM design calls for a two stage solid propellant missile capable of launching four boosters at a shot. Guidance would be influenced with an alternative geostationary station. The Navy will participate to ensure adaptability of the system for geostationary use.

The installation and checkout, 20 requires six programs (RP) was sent and eight cycles required. For the receive system, 12 RP's were tested and seven cycles required. Seven RP's were sent for the payload return and four one cycles required. For the transports launcher 19 RP's were tested and one mission was required. A total of 47 RP's were sent for the transport and control system and nine from required. The guidance 13 RP's were tested and one cycles required.

The flight procurement has not yet signed a fixed contract for 23 vehicles. 11 HCs scheduled to be built for the Svalbard. At this time, in the course of 1968, 10 more contracts of East Antarctica. Meigs, So. Meigs, Puerto Galera and SACA.

Flight procurement, initially estimates that the Indian program by construction of a total of 200 aircraft will consist in three SIAI 100 aircraft in overall 100 aircraft, including 100 aircraft for the Indian Air Force. By this time, the force of aircraft 100 and for 5 years and long leadtime stores.

Meanwhile, North American Avionics Inc., announced that completed 50 million for the sale of NASA's LTA aircraft control system and associated support equipment for the F-104C/Cs. This firm signed with the European firm, Tungsram Avionics Apparatus Radial of Miskolc, Bally, Montechine, Brugge et Louvain de Molenbeek Electronics at Bruges, N. V. Belgium. Subsidiaries of The Netherlands and Tafelblad, Gouda of West Germany.

NAVAIR Antennas Division, which manufactures the LTA, initially in cooperation with the Italian company, Alenia Spazio, has been assigned to perform dynamic studies at least one of the six weeks for the final assembly and testing. The contractor will continue the definitive phase. Guidance study will be single stage General Precision Inc. Four test sections in conjunction with each of the following areas, integration assembly, configuration, systems, avionics, propulsive and transverse launcher.

**USAF Awards MMRBM Studies**  
Washington—An Army task force recommended what amounts to the classified version of the majority of contractors to perform dynamic studies at least one of the six weeks for the final assembly and testing (AVW July 18, p. 11).

Four major contractors and several small firms will continue their work throughout the definitive phase. Guidance study will be single stage General Precision Inc.

Four test sections in conjunction with each of the following areas, integration assembly, configuration, systems, avionics, propulsive and transverse launcher.

The MMRBM project was the first one chosen to become Svalbard. Robert S. McNamara to replace responsibility in Phase 1—the definition phase the procurement of a weapon system before going into Phase 2—the development phase (AVW April 2, p. 21). The proposal has been based by design called for requirements in the original terms in NARD mission and implements some form of methods of employment.

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**X-15 Control Tested Without Yaw Damper**  
Light took to determine whether North American's X-15 model research aircraft would be controllable after failure of its yaw damper has been diagnosed by Trint Polar-Ned Manufacturing of NASA.

Proposed changes, procedure called for the speed brakes to be extended and the steerable tail to be made with a range of attack of 15 deg. when the yaw damper was disabled. The pitch trim probe controls the control surfaces, thus, roll and yaw movement. The difficulty is the trim probe.

Accordingly, reported that the hard landing of the aircraft, specifically tail up and nose down, was "most walk" to control it. There is no true rudderrole, so braking force of the 100,000-lb. pitch attitude reached during the flight

# Three-Service Group Study Aims To Unify Tactical Reconnaissance

By Larry Boorda

**Washington**—A three-service study is under way aimed at unifying tactical reconnaissance aircraft and ground-based sensor systems. The study, which is being funded by Navy Gen. Dan O. Davis, USAF, has been meeting here to compare a lot of sensor requirements to be presented to Defense Secretary Robert S. McNamara.

High-ranking military officers look on this study as the first move in another major defense project initiated by McNamara.

Gen. Davis, deputy chief of staff for plans of the Air Force Tactical Air Command, was directed to examine the entire spectrum of tactical reconnaissance and electronic warfare aircraft which would separate and field them as separate units. Overall, 145 aircraft are being considered for use by the combat command.

McNamara's action is continuing the broad emphasis on retention of flying units with the traditional separation of tactical intelligence-gathering activities of the services. Overlapping acquisition methods would be eliminated and all assets would be fed into a common acquisition system for use by a central control authority.

Military procurement would also be affected if these assignments were to take place. Competing interests would disappear and new systems satisfying certain requirements would replace them.

In general, the tactical reconnaissance

capabilities of the Air Force, Navy, and Army would differ little from each other. An average of advances in technology—especially in the acquisition of sensor systems which feed this data into computers for rapid analysis.

For example, reconnaissance aircraft systems in various stages of trials and development will feel the effects of improvements made in the Defense program. Closer to operational status is the Army's AD-1 Canisteo Marlin, battlefield reconnaissance aircraft. One version of this aircraft would carry side-looking radar and the other would place its cameras on photographic film.

Another in development is the Air Force's modified USAF-5, a drone aircraft, a converted Cessna 172, because of the Navy board. Further development funds for it were not requested in the fiscal 1967 defense budget.

## AJ-3 Test Due

Navy's North American AJH-3 reconnaissance version of the supersonic Vigilante, twin-engine bomber to due for its first full mission no later than fall. This system would integrate electronic and photographic sensors in the aircraft and would feed results to surface computers.

The conventional North American RS-70 proposed for the Air Force could be part of the combined tactical reconnaissance system, although the Air Force currently is of a purely reconnaissance nature. The RS-70 would utilize both electronic and photographic sensors.

Other have been placed for these aircraft.

In tactical situations, the Navy also depends to a great extent on aerial photography. Blockbuster versions of fighters are deployed as aerial attack aircraft carriers. In addition there are 200+ Lockheed F-104 and Douglas A-3D aircraft assigned to these carriers on the planned nuclear deterrent.

Navy Tactical Data Systems (NTDS) encompass all attack and defense systems, including surveillance systems. No Air Tactical Data System (ATDS) will feed into the NTDS.

Marine Corps reconnaissance operations combine air and surface systems with the combat usage, analyzing data by means of night observations in daylight and infrared spotting devices at night.

Tactical reconnaissance is the specialty of the Army. Light plane observation is conducted with activities of the ground troops. Data is communicated with that ground via tactical Air Commando units.

At present, the Air Force is a priority related to tactical aircraft which involves command and control of United States Forces (USAF) July 30, 1967. The general has the approval of the services.

# Soviet Tests Cited as Peril to MA-8 Pilot

By Edward H. Kolens

**Washington**—Pilotless, based in U.S. space flight, Soviet flights from an unnamed Soviet high-altitude nuclear test site have been pointed out as possibly near-miss flights for the next Strategic Arms Limitation Treaty (SALT) summit of Gen. Walter M. Schlesinger and Gen. Anatoly Gromyko.

Defense Department and National Aerospace and Space Administration are confident that the Soviet Union will not detonate a nuclear war weapon while a U.S. aircraft is in flight, but there is some concern that as many advanced Soviet jet aircraft could do. It remains cause for concern.

Unlike the U.S., which has been relatively specific in announcing an high-altitude test which Russia has not yet generally announced in its test statement.

U.S. aircraft have not landed a nuclear flight for at least 24 hours after a high-altitude test because of the danger of residual radiation, both to the aircraft and to communications. U.S. aircraft involved in the two previous NASA and Defense Department in uncrewed space flight and the Atomic Energy Commission and Joint Task Force 5 in the Pacific test series have landed and are awaiting which group NASA, power in schedules. If there is any significant delay in the XMAS flight, the agency has agreed to postpone launch for 10 days during which the nuclear tests will be held.

Although some feel the U.S. should strengthen in track the same type of agreement with Russia, the State Department told *Aerospace Wire* there

are no plans to give specific notifications of the XMAS flight to any nation. State Department and the Defense agencies have sufficient information of location.

NASA officials estimate a launch about 10 days before the scheduled date. Present launch date for XMAS is Sept. 18, and in the past there has been a sizable buildup in payloads during the week preceding normal U.S. launches.

Potential hazard to manned space craft of high altitude nuclear tests was brought to the attention of the Defense Department by Project Manager, suggested by the Atlantic Missile Range.

Detonated specialists and physicists did not completely agree that radiation from nuclear tests at high altitude is a danger. Some studied that nuclear weapons are designed to rapidly heat a payload so problems to a pilot caused in a nuclear vessel like the Mercury capsule pilot equipment. This was explained in which standard aircraft were lower through atomic clouds immediately after detonation with no ill effects on the pilots.

Mercury engineers, however, cited the possibility of atmospheric ionization and hazards from residual radiation.

Cdr. Schlesinger's MA-8 capsule will contain a radiation dosimeter experiment but it is designed to determine the change in composition of galactic cosmic rays. The dosimeter will be used to measure total dose and dose rate to the crew.

The others are:

- Ultraviolet spectrometer, to be fitted in the portside window.
- Heat preference meter, to be used to baseline thoughts around the capsule neck.

• Fly whisk to determine the ability of the pilot to see a small light source on earth.

• Photopilot with hand-held camera. Cdr. Schlesinger began training with the unique photopilot Aug. 1. Photopilot is a modified electronic eyepiece developed for MA-7 flight (AVM 80, p. 58). It is used prior to presentation of the return from seeing the Earth. For the MA-8 mission, film will be loaded from Woomera, Australia, and Durban, South Africa.

The 10-km ultraviolet spectroscope was designed, built and calibrated by Larry Thresherman and Dr. Albert Biggin of NASA's Goddard Space Flight Center. It will collect ultraviolet radiation in the visible ultraviolet range, 3,800-5,000 angstroms during night, daylight and twilight.

Cdr. Carpenter during the MA-7 mission used a film over the periscope

to disperse the strong image cast in the eyebox and Cdr. Schlesinger will attempt to extend this observation. The spectrometer consists of a mirror, a quartz prism and a colorless quartz lens. Ultraviolet is separated and focused through a slit to a cosine grating, which focuses it on 16-mm film sensitive to the spectrum.

The evanescent experiment proposed by Dr. Carl Field of Goddard, will be the first attempt to obtain the charge composition of galactic cosmic rays in a satellite. The experiment is expected to produce results not directly related to the interaction of cosmic rays with the earth's atmosphere, a factor which has been a previous experiment in balloon flights.

The experiment consists of 70 separate radiation planes in a block which will be exposed during the entire flight on the top of the payload can.

**Aries**—Melbourne Aircraft and NASA's Langley Research Center are providing a series of heat protection materials, some of which will be tested and tested and then reheat repeated prior to flight. This will give NASA data on the effects of heat shield repair, and how a repaired heat shield survives reentry.

## Atlas F Launched From Prototype Site

First flight of a Soviet F Atlas (MA-8) from an operational prototype site left launcher was completed successfully last week from Vostrochny AFB in a Strategic Air Command launch site of the 175th Strategic Missile Squadron assigned to personnel from Central Aviation Administration and Air Force Strategic Command's 699th Aerospace Test Wing. Previous Atlas F launches have been from fixed vertical pads at Cape Canaveral.

In the Vostrochny ATB launch, the mobile launch site is hardened, background noise was raised to the surface and burried.

## Spare Flight Trainer

An Air Force located indicates representatives last week on inspection plane aircraft in a spare flight simulator trainer capable of real time simulation of two types of one-man space vehicles.

USAF is seeking a contractor to design, develop, fabricate, install and maintain the number. Testing was held at Edwards AFB but procurement is being handled by Avco/Aviation Systems Div.



Belfast Model Shows BLC Configuration

Short Belfast tailplane on longtail being offered by Ward Air Force as a Blackstone Beverly replacement, features Roll-Rivet tailbooms/pins on model, since Compresso requires through bolts to wings and struts for bonding fastenings giving the aircraft STOL characteristics. Short says it could deliver the STOL version with fully retractable landing gear in 1968-69 (see box, p. 26).

# New Army Materiel Command Begins Vast Management Task

Washington—Army Materiel Command (AMC) last week assumed control over a widespread complex of management activities, laboratories and test facilities engaged in developing, testing and producing weapons and other materials for the Army.

The command's name was changed to reflect four Materiel Development and Logistic Command (MDLC) which it had been called in the original reorganization of an Army Materiel Command (AMC) Jan. 22, 1964.

AMC's commander, Lt. Gen. Frank S. Davis Jr., will be responsible for expenditures of \$7.5 billion a year for such operational areas as technical services, weapon systems analysis and research and development, procurement and production, storage and distribution, materiel management and disposal.

Seven commands will be established, which all become operational Aug. 1, will report to Gen. Davis. They are:

- **Weapons Command**, headed by Maj. Gen. Charles M. Lunde with headquarters at Rock Island Arsenal, Ill., will be responsible for major weapons and weapon systems; Rock Island Arsenal annexes at Watervliet, N.Y., and Springfield, Mass., and the Ordnance Weapons Command at Rock Island will report to him.

- **Munition Command**, commanded by Maj. Gen. William H. Chidester with headquarters at Fort Monmouth, N.J., will be responsible for munitions, chemical, biological and radiological systems. It will oversee:

## Aerojet Rockets

Army General Corp's unit-produced long rocket plant, Sacramento, Calif., will supply booster rocket motors for Ed-200 2-ton vehicles to be designed and built by General Dynamics/Cessna, the announced subcontractor for the command and service modulus of the NASA Apollo program.

At this application, the Army General Corp, designated by NASA, will be the contractor for the maximum-service test mission and cover the duration of the orbital flights.

Also announced from NASA, Army will build 25 Service Moduls, which will have improved service modules and a third of sheet 110,000 lb. Face will be used to demonstrate a new reentry module, which will be used to assess the proposed reentry for the specific launch. Major delivery will begin this year and will run through 1964.

Fairchild, Avco, Philadelphia, Pittsfield, Avco, Pittsfield, Avco, Denver, Avco, Chemung Corp., Md., and others are involved in these activities.

■ **Militia Command**, headed by Maj. Gen. Alvin K. Stille, located at Denver, Colo., will be responsible for phases tasks, information equipment and other transportation material. Reporting to him will be the Transportation Materiel Command at St. Louis, Mo., the Quartermaster Equipment and Parts Command Center Office.

■ **Mobile Command**, commanded by Maj. Gen. Purce J. McNamee with headquarters at Redstone Arsenal, Huntsville, Ala., will be responsible for mobile missiles, ground vehicles and systems. It will supervise the Army Proving Grounds, White Oak, Md., the Army Proving Grounds, Aberdeen Proving Ground, Md., the Army Proving Ground, Ft. Monmouth, N.J., the Army Proving Ground, Ft. Rucker, Ala., the Army Electronic and Aerospace Research and Development Center, Fort Monmouth, N.J., and the U.S. Continental Army Command and test facilities in three other states and Puerto Rico.

# IATA Seeks to End Mail Order Travel Tie

Pan American protest spurs tour investigation; SAS association with Gold Bond trading stamps probed.

By James Adcock

New York—International Air Transport Assn. is attempting to halt tour promotion programs involving Pan Am, Transair, American Express and the nation's two largest mail order houses.

It also has begun investigating Scandinavian Airlines System's cooperation with Gold Bond stamps (Aug. 13, p. 37).

Pagan says, with Management West and American Express with Sean Roche, that program is reported to have generated \$20 million in revenue. The SAS/Gold Bond effort was to generate 1,000-2,000 new transatlantic air travelers this year.

IATA's action is based on the grounds that Windt and Sean's offices are not IATA-member tour operators. However, Roche, who signs contracts in his Windt and American Express offices personal name Sean or IATA-unauthorized at their own offices.

The trip came just as Pagan's 18-page tour document, which cost the agency \$500,000, was being rolled off shelves in the Pan Am catalog. Roche claims an Atlantic tour, authorized by American Express, though no 18-page brochure is in the Sean catalog.

The IATA action stemmed partly from a complaint by Pan American World Airways, which charged that the programs were infringing business areas held jointly by agencies in violation of the IATA rule on tour sales.

Pan Am's explanation in the letter to the complained procedures is that "the promotional procedures of the tour operator do not allow for individualized offer details of which tour national tour could not be treated to anyone except experienced tour agents."

This could set him sales back to the days when agents could open a travel agency in a drugstore or on the street corner," a Pan Am spokesman said. "We don't want to see the level of competency lowered in the travel business, and we don't think other carriers do either."

William Pagan, head of the firm company, did not accept the Pan Am explanation of the IATA enforcement procedure.

"Before we received the notices we held a meeting with the IATA agency committee and outlined it to [Pan Am's] Pagan and [Pan Am's] Sean," he said. "There was no complaint there."

He said it was wrong to categorize that Windt's 1,100 offices were acting as tour agencies.

No offices are being sold at the office, Pagan said. "These are not even regular stock purchased there."

He said the offices are merely contact points. Once a passenger checks in at a tour, the office goes to Windt's Chicago headquarters, a partner, and the agency handles everything from there.

"We've followed up potential tour sales within 45 hours by long distance telephone," Pagan said. "The combination of prompt service and long distance calling allows us to impress people, and it has paid off in sales."

American Express works directly from management offices and responds to the tour operator's needs.

With Pagan and Windt, American Express takes care of all the selling, advertising and billing once a tour is booked. Payment may be made in installments or with an other Sean or Windt partner.

Pagan was particularly irritated with Pan Am's action, in the tour agency had just signed a contract with Pan Am for a \$1.2-million charter for Norge, the oil of SAS.

**Near-Collision Probe**

Washington—Federal Aviation Agency has suspended a controller and an air traffic controller pending investigation of a near-collision between a Pan American Boeing 707 and a Trans World Airlines Convair 880 over Eastern law.

TWA flight 78, enroute from Los Angeles to St. Louis, was assigned an altitude of 31,000 ft. It was in flight control area 1, Pennsylvania, N. Y., FAA said. American flight 875, westbound from Cincinnati, was operating at the same assigned altitude as TWA's flight 78 over Eastern law.

Both aircraft were under radar control at the time of the incident.

Bog Warner, enroute from its approachway 3,400 ft above the airplane manufacturer's hangars.

Pagan said that morning Pan Am's Norge charter which last year went to Trans World Airlines, not not a cold genius to squelch Pan Am's complaint against the program with Windt.

However, IATA insists that since no one Pan Am division it should apparently be complaint to IATA's Pan Am.

Pan Am said that as far as the Norge charter is concerned, it was stretch a business deal with no connection to the other writer.

"We feel Pan Am deserved the Norge business simply because we offered the best seat and service," a Pan Am spokesman said.

Warning letters sent to Pagan and American Express by E. S. Pihlman, IATA executive director, followed a series of the first program by the IATA travel agency association. Pihlman and American Express are both TWU-enrolled tour operators, both having signed agreements that they would comply with the association's rules governing the sale of international air transportation.

Among those rules is the stipulation that the rebookable tour operator's location at which international travel is sold.

"I expect to inform you," Pihlman writes in American Express and, "that the economic board that the promotion and sale of international air transportation through retail 'wall' sales outlets department store outlets constitutes a violation of your SASA Agreements and other applicable associations of IATA."

The committee has already discussed an action case that these relatives cannot be confirmed without investigating into IATA opinion as all can either on behalf of IATA members must be conducted, pursuant to the terms of your SASA Agreements and other applicable associations of IATA."

John D. Stewart, American Express vice president and the Atlanta tour manager, said his organization has designed to meet all terms of the IATA resolution and that American Express will not determine from the local IATA office where the violation occurs. The response plan to ask IATA for help if needed.

Both Pagan and American Express plan to examine their program until more definitive information is received.



Pan American Operating Boeing 707-321Bs.

Pan American World Airways is operating Boeing 707-321Bs nonstop between New York-Jewett-Caves, Los Angeles/Los Angeles and Honolulu-Sydney. Aircraft carrying 188 passengers has 6,000 mi range. It is powered by four Pratt & Whitney JT3D-3 turbofans.

## Pan Am, American Report Threats, Slowdowns During Negotiations

New York—Slowdowns in members of the Transport Workers Union last week delayed Pan American World Airways flights at Idlewild as much as an hour following a protest set in July against Airline Pilots' wage increases.

Pan Am spokesman said the one-day slowdown disrupted operations through out July 31 and into the following day. The protest, which involved 1,000 unionized Airline Pilots Association, Kansas City, Kansas, flies for Pan Am, was held to protest wage increases in the airline.

SAS, which canceled the plane out of each port in the program is that of the carrier, Minneapolis, and Gold Bond handle all promotion selling and fare managing. A spokesman for that Minneapolis and Gold Bond was SAS present the travel agent for flight certificates which at the bottom in center.

The SAS/Gold Bond issue differs from that of Pagan and American Express in that Pan Am and American Express have their own travel agents, while SAS' travel agents are not part of the airline. Consequently, no question is in the court about responsibility of the IATA enforcement officer either how a take-down notice such as that regarding travel agents.

Pagan's IATA concern is how closely SAS is allied to the program, whether the airline controls the program, and who would get the gift certificates. SAS' version of the investigation is a telephone call from the IATA enforcement office asking for a detailed outline of the program.

An IATA enforcement officer asked Pan Am and investigation of the program in response to complaints in other countries, and no conclusion have been drawn.

The union apparently never re-

ferred to style when it made such a statement, "However, the action did not affect us."

American said that strike slowdowns were held on July 31, Aug. 1, and Aug. 2, and that the pilots' rights. The union also made a point when the union's cabin crew also took a day off to protest those.

American said that Pan Am style Pan Am at midnight would strike and cancel a number of inbound connections for weekend travel.

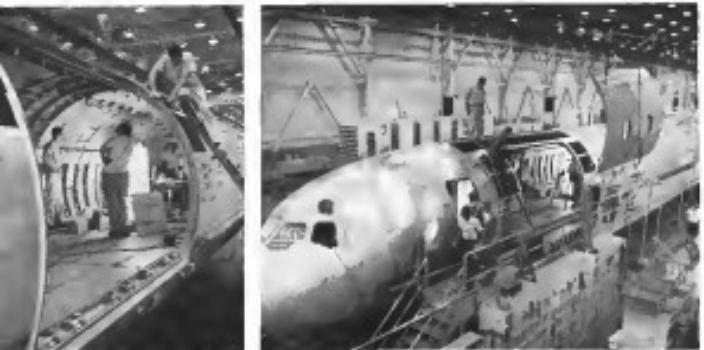
The Transport Workers Union is demanding the strike ends at 11 p.m. closing that Pan Am had refused to begin in good faith a new contract. The contract covering 9,450 Pan Am employees became effective June 1.

A TWU spokesman at the announcement said that Pan Am's last offer did not meet the demands of the TWU enforcement officer either how a take-down notice such as that regarding travel agents.

Pagan's IATA concern is how closely SAS is allied to the program, whether the airline controls the program, and who would get the gift certificates. SAS' version of the investigation is a telephone call from the IATA enforcement office asking for a detailed outline of the program.

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The union apparently never re-



Rear cargo door for DC-8F jet trailer, Douglas cargo-passenger freighter, is lowered into place at Long Beach factory.

## Cargo Door Installed on First Douglas DC-8F



Data maximum 65 x 240 in. to facilitate rapid loading of palletized cargo. Total DC-8Fs have been ordered for 1965 delivery. Aircraft can carry up to 95,282 lb. of cargo or 183 passengers at a cost of about the 1965

## Seven Trunklines Show Six-Month Profit

Washington's domestic trunkline carriers reported net earnings for the first half of 1962, though seven of the 11 carriers will show a profit for the second, but that these will be offset by deficits of the remaining four, resulting in an overall loss for the industry.

At the last week, six of the domestic trunk carriers had reported net earnings for the first six months, with the majority showing substantial gains over the same period last year. In some instances a healthy second quarter period helped to offset losses of the first quarter either to write off first quarter losses or to strengthen flight loadings for profit margins.

Midwest, Northwest and Western had used limited English credits to finance last work. Western is expected to close a credit for the second. Northeast Eastern and Northwest are expected to report losses. Last month United Air Lines reported a loss for the six months (AVW 160, pg. 23).

TWA reported very favorable net loss after taxes of \$12,427,000, compared with a loss of \$11,734,000 for the same period last year. Gross revenues for the period totalled \$484.1 million against \$466.5 million last year.

For the first six months of 1961, the 11 trunklines had operating revenues of \$602.9 million and operating expenses of \$591.9 million for a net loss of \$10.1 million. After taxes, non-operating revenues and special items, Net loss for the corresponding period in 1961 was \$16.120.000.

American Airlines reported net loss of \$13,266,000 for the first six months of 1962, compared with a net profit of \$2,540,000 in the same period last year. Revenues for the period rose 11.4% to \$228.5 million while total expenses increased to \$226.2 million. Revenue passenger miles increased 11.7%.

Braniff Airways reported net earnings of \$1.6 million for the six months compared with a loss of \$37.980 in the first half of 1961. Operating revenues for the period rose to \$47.2 million, 9.5% above average over last year. Operating expenses rose 8% to \$44.7 million. Revenue passenger miles showed an 8.6% gain.

Continental Air Lines reported a net profit of \$376,000 on revenues totaling \$11.5 million for the first six months of 1962.

Net earnings for the first half of 1961 were \$512,000 and revenues for that period reached \$10.5 million. Total operating expenses for the first six months of 1962 amounted to \$29.5 million compared with \$28.3 million in the same period last year.

According to Robert E. See, Con-

tinental president, the company lowered its maximum revenue bracket load for the first half of 1962 to 42.4%, the lowest in the industry, and 1.2% below the load factor level of 43.6% attained last year.

Delta Air Lines reported a net income of \$6,985,000 for the fiscal year ended June 30, equal to \$411 a share on 17,000,000 shares outstanding.

Profits included a net of \$1.3 million on the sale of aircraft. Net earnings for fiscal 1961 totalled \$4,652,000, including \$526,000 from the sale of an oil well.

Operating revenues for fiscal 1962 reached a record \$169.7 million compared with \$145.1 million reported for the same corresponding year. Actual test yields should be 22% compared with the previous year, while revenue passenger miles rose 19% to come load factor is up from the 1961 fiscal at 60.7% to 65%.

### Flying Tiger Profits

As the defense carrier, Flying Tiger Line reported a net profit of \$1 million for the first six months compared with \$741,901 in the same period last year. Earnings for the second quarter of 1962 reached a record high of \$721,261.

Sokatra Division of the Shok Corp. reported revenues totaling \$9.1 million for the first six months compared with \$4.5 million last year. Net profit for the Shok Corp., which includes profits from the Hanov Shokra Division, was \$106,324.

Southern Airways earned \$127,217 in the first six months, the highest profit level in the carrier's history.

North Central Airlines had a net profit of \$39,002 for the period, compared with a profit of \$63,988 in the same period last year.



### First Kawasaki-Vertol 107 Demonstrated

First Kawasaki-Vertol 107 non-turbine, twin rotor helicopter built under license in Kawasaki, Japan, history was demonstrated recently at the producer's facilities. Kawasaki will build two V-107s for Thailand as part of an agreement to that country and 10 additional aircraft for domestic users. All will be delivered by the end of 1963. At the controls during the demonstration flight were James Kelly, Boeing Vertol test pilot, and Kanjiro Matsukage of Kawasaki Aircraft.

# Official statistics reveal: 1. Local service industry paces airline growth; 2. Shell is still its leading fuel and oil supplier. Here's why:

ATA statistics just released show that local service airlines led our scheduled airline industry growth in 1961—and are off to an even better start in 1962.

Here are some little-known facts about our hard-working local service airlines, and Shell's place in their past, present and future.

**L**AZY YEAR, America's 15 local air carriers earned 5,476,000 passengers, 5,481,000 ton miles of freight and 3,586,000 ton miles of mail. They flew 302 aircraft, many of them too big.

The average distance between local service stops is only 79 miles. Despite this, local fliers logged 1.3 billion passenger miles in 1961.

Of the 300 cities they served in 1961, local fliers provided the only scheduled air transportation for 371.

In their 15-year history, local lines have won public and industry confidence with outstanding service. Here are three examples:

- A dirigible by direction dry berths a transoceanic liner. An innovation developed by the state university, who turned to fliers by a local service in time to prevent service losses.

- Soon after local air service made a once isolated community one of the hub-and-spoke in the East, an electronics company chose it as a plant site. Hundreds of jobs were created.

- Thanks to local air service, a traveler from Coffeyville, Kan., can be in London in less than 12 hours, one flight from Kans. No, he is on this 10.

Such service is paying off. Local service passenger mileage for 1962 is running 17.5% over 1961's record rate. There's no letup in sight.



Symbols of leadership: Fifteen of America's 15 record-setting local service airlines—Shell supplier #1 or part of the fuel and oil for 11 of them.

## II of 15 flocks to Shell customers.

When the local air industry began, Shell was its leading fuel and oil supplier. We will stay raison. Of 50 years of aviation product leadership and fuel handling and laboratory experience.

Eleven of the thirteen locals are Shell customers. Many of them have used Shell products since their founding. For example:

In 1945, Shell supplied all the AVGAS and oil for one of the first local airlines. Today, shell lines are one of the industry's most vigorous. We will supply all its AVGAS, oil, and new turbine fuel.

**Shell service helps local grow.**  
Shell serves local airways with more than fuel and lubricants.

Shell representatives are constantly at work helping local fliers increase operating efficiency and economy. Here are two cases in point:

- Shell engineers help local lines design and build fuel facilities—then

help iron ground crews on efficient refueling techniques, quality control and safety.

• Shell laboratory engineers meet regularly with local service airline maintenance experts and suggest improved lubrication methods.

Shell is proud of its long association with local service airlines. We look forward to many years of service to this industry which plays such a distinctive role in the most demanding fields of American aviation.



# Justice Department Deals Blow to Merger

By L. L. Doty

Washington—Majestic aspirations to the postwar American airline industry were dashed last week, in a warning from the Justice Department to the Civil Aeronautics Board that the merger would be contrary to President Kennedy's call for competition set forth in his transportation message last April (AVW, Apr. 5, p. 8).

Although airline mergers are exempt from antitrust prosecution under the Clinton Act and the Justice Department statement seven days ago to advise the Board, failing in strong terms that the warning will have a strong influence in the final Board decision. In its brief filed last week with the CAB, Justice urged the Board to follow that course of competition but said that if the President's command could not be carried out, it will place the CAB in a "position of concentration and stagnation" which is hostile to the President. It cited:

"Little will be accomplished in the public interest by the bold move recommended in the Plaintiff's suit to deal with the transportation problem of the greater Boston and surrounding regions unless that the President's command is to be achieved by only a handful of surviving transport companies."

Indeedly, the airline field is a house kept that the White House will disrupt, the merger even though the Board, in its final decision, may approve it. Since the Board's statutory role is to review the Plaintiff's decision will merge go to the President?

Then the Justice brief is an early blow to the merger hopes of the two carriers and could cause the Board to review its previously stated position that it would look favorably upon merger that proved to be in the public interest.

Most airline officials have felt that approval of the American-Boston combine would create a forest of other carriers in the only means of attaining equal competitive strength.

## Revere Trond

Some officials have confidently predicted the with seven years' worth of the machine industry, a large amount of no more than four to five aircraft. However, the Justice brief, coupled with carrier opposition and strong signs of congressional resistance, could well force the Board to give more weight to strength in merger proposals.

United said in its brief that there is no resemblance between its merger with Capital and that proposed by Eastern and American. It said that if it is nevertheless felt that the two engines will be comparable and that American and Eastern would attempt to give the District/Capitol areas a point in support of their planned merger.

Eastern said that its merger had less competitive impact on the industry than would the Eastern-American merger.

of the merger an offset carriers would jeopardize their financial condition. A smaller carrier such as Northwest could be threatened from some of the present major, the Justice brief said.

It concluded that the proposed merger could "flagrantly violate" antitrust exemption.

Of all the pack players, only Western Air Lines failed to file a brief in opposition to the merger. Both United Air Lines and Trans World Airlines opposed the proposed union, but did not press their position vigorously during the hearings.

In its brief, American argued that it was selected by President Kennedy's transportation message that proper mergers allow the private sector to restructure the industry, which, it said, was unable to attain a reasonably smooth ocean during the last few years.

The airline and the merger will affect route concentration and thus increase traffic and load factors of other carriers in a number of markets where distribution of service is greatest. The merger would help other carriers in several ways. American said and argued that two—TWA and Northwest—have "left the tree" from the merged carrier's view.

## Thrust Debated

"These two carriers are owned by one of the world's wealthiest and most powerful men, Howard Hughes, and obviously have the financial resources from across America," said Continental. Delta and Pan Am also have argued to law for them. They have proved they can not only meet but beat much larger carriers than themselves."

American concluded that it is uncertain, but it is doubtful that impact on other carriers should be a controlling consideration in merger cases. It said:

"If a merger creates unfair terms and will contribute to the development of a robust air transportation system, the abuse of power of other carriers which in all likelihood will be merged with the merged carrier should not be allowed to stand in the way of progress."

United said in its brief that there is no resemblance between its merger with Capital and that proposed by Eastern and American. It said that if it is nevertheless felt that the two engines will be comparable and that American and Eastern would attempt to give the District/Capitol areas a point in support of their planned merger.

The carrier said that its merger had less competitive impact on the industry than would the Eastern-American merger.

Capital Airlines filing condition at the time of the merger was to abide strictly according to Western's condition, Union said.

Delta Air Lines, one of the strongest opponents of the merger, charged that American's attempt to merge with Eastern is another step by American to buy a southern transcontinental route which the Board has previously denied it. The carrier said American President C. R. Smith intended to instances that he had attempted to negotiate a merger with National both before and after the Board's decision against American in the Southern Transcontinental Route Case.

## Eastern's Route

Delta added that thereafter, Smith turned to a merger with Eastern which would permit American to operate over a coast-to-coast new southern transcontinental route.

Continental charged that the creation of such a giant as American-Eastern alliance would detract the nation's 74-year-old regulatory system because of the conglomerate powers with which the combined carrier would dominate the industry.

Continental said it was clear that the proposed merger was not needed to "bolster" Eastern from Eastern's difficulties, it was the case with the merger of Capital and United. It said that Eastern President Malvina A. MacLean emerged scot-free during the hearings that merger was not up to being a "thriving business."

## Air France Registers \$1-Million 1961 Loss

Paris—Air France, with an overall loss of \$55.4 million below budget for 1961, registered a paper loss of \$175,000 last year, according to Board Chairman Joseph Raco.

Raco told a recent session of the tax board that although its 1961-62 fiscal passenger figures showed a 23% drop in domestic traffic, the airline lost money by 75% through non-operational decreases. Overall traffic per passenger mile, he said, increased by 13% as opposed to an average boost of 6% for other international airlines, Raco said.

Total operating revenues for the year were placed at \$392,515,589. The financial loss, which entered the carrier's total deficit to \$115 million, was compensated after the airline had added a stay-ahead of \$105 million and subtracted on the other hand, \$1.8 million which it placed in its reserve fund.



## The man who won't get off our back.

Here's the Flight Dispatcher. His job is to make sure all American flights are flying out of or into his area. He must get flights off on time. Simple? Not always. Uncontrollable factors (like weather) can cancel in coming flights. Result? No room to coordinate schedules to make sure he

has a plane when he needs it.

Next, he and the Captain develop the Flight Plan. It must meet American's requirements on flight conditions and routing. It all is O.K., the flight can take off.

But he still won't go. He keeps in touch with the Captain by radio. All

he has to do is make sure the flight will make the flight safe and comfortable. Even after a flight takes a Detour, he will debrief the crew for data that may improve our service.

Next time you fly with American, remember the man who won't get off our back.

**AMERICAN AIRLINES**  
AMERICA'S BIGGEST AIRLINE

American is a Service Mark of American Airlines Inc.

## Bird Ingestion Confirmed as Crash Cause

Washington—Civil Aeronautics Board last week advised its findings in four aircraft accident investigations, including the long-sought conclusion that engine ingestion of seagulls was the probable cause of the Eastern Air Lines Lockheed Electra crash at Boston on October 4, 1966 (AW, Oct. 12, 1966, p. 4).

The Board's accident report on the Eastern accident, which followed the action of former Federal Aviation Agency Administrator F. K. Smith to ban unpermitted aircraft from ground areas around airports, found that the two engines had ingested birds. The report said that there was no evidence of structural failure that would justify removal of the aircraft from scheduled service.

Other CAB verdicts in accident reports issued last week included the loss of a Continental Air Lines Boeing 727 124 near Louisville, Ky., on May 22, the crash of a Beechcraft D-15 at Elmont, N.Y., on July 15, 1961, and an Aeromexico Douglas DC-8-5 airplane crash at New York International Airport on Jan. 19, 1961.

The probable cause of the DC-8 accident was attributed to incorrect steering of the rudder by the check pilot, who was in the plane seat. Control rod failures were suspected as that steer on the rudder and an antiicing heater possibly set it free.

The Eastern accident appears to have been induced by an open cabin door CAB said. It attributed the probable cause to a serious deficiency in the pitch control during the climb with both of the two engines running in lieu of normal inboard trim, due to fire soon after.

The Beechcraft accident appears to have been induced by an open cabin door CAB said. It attributed the probable cause to a serious deficiency in the pitch control during the climb with both of the two engines running in lieu of normal inboard trim, due to fire soon after.

The Board and those men in power believe that we are in some passages now more interested with the controls at the point to cause the aircraft to stall.

The Board determined that the probable cause of the Continental accident was a dynamic explosion in the right rear location. It said that examination of the aft fuselage panel confirmed that the forces which caused the initial investigation concluded from a point within the small fuselage area beneath the tail section of the right rear fuselage.

In its report on the Eastern Electra crash, the Board said the aircraft struck a flock of seagulls a few seconds after becoming airborne. A number of these birds were ingested in engines Nos. 1, 2 and 4. Engines No. 3 was shut down

and in propeller feathered. Nos. 2 and 4 experienced a momentary cessation of power, causing the aircraft to roll to the left and descended to stall speed.

When stall speed was reached, the left wing dropped, the nose pitched up, and the aircraft rolled left into a spin, falling almost vertically into the water at the edge of Boston's Logan International Airport.

Tests were conducted with an Electra aircraft by the Office of Civil Aviation at the Lockheed Aircraft Corp wind tunnel at Burbank, Calif. CAB and Manufacturers were satisfied with the engine inlet ducts in power controlled combustion of birds. The tests brought out the information:

- Torque-shaking ingestion at cruise power decreased ship "approximately 15% after 400 ft/sec. of bird impact power approach switch 10%."

- Power-shaking ingestion at idle power decreased ship about 15% after 400 ft/sec. Power lift is regenerated 900 deg less than half of that required for a climb of 3 ft/sec. An altitude increase of 1000 ft was measured in one of the three tests conducted.

- Severeing ingestion at idle power decreased ship approximately 25% after 400 ft/sec. In one instance, the engine failed to recover. In another, less than 15% power was available for 4 sec.

The Board is satisfied that the tests reasonably simulated engine behavior in continuing with the program.

## FAA Budget Cut by \$70 Million

Washington—House last week passed some \$70 million from Federal Aviation Agency's Fiscal 1967 budget request, including \$10 million of the \$25 million for the environmental transport development and \$15 million of the \$40 million asked for research and development.

The agency asked for \$80.5 million and the House approved \$73.6/65.000.

FAA research and development budget was to have funded the initial steps taken to implement the Project Baseline air traffic control system (AW, Feb. 30, p. 18). Although the House approved a \$27.5 million reduction of respect Fiscal 1962 money, the use of the rest was longitude, FAA however recommended plan if it is approved by the Senate.

The agency asked for \$10.5 million and the House approved \$7.9/65.000.

The House research and development budget was to have funded the initial steps taken to implement the Project Baseline air traffic control system (AW, Feb. 30, p. 18). Although the agency had requested \$40.5 million of the \$45 million in the House requested a \$20.5 million increase over the Fiscal 1962 appropriation.

Approved \$120 million for new facilities and equipment; the same amount appropriated in Fiscal 1962, and \$15 million less than FAAs budget on file.

House appropriations committee, in during FAAs civil aerospace transportation request to \$15.5 million, expressed hope that thoroughly studies of the aircraft

flight. In the report it concluded that, aside from possible structural damage birds ingested into the engine will reduce power output by blocking rotors, decreasing compressor surge efficiency with surface debris and disturbing gas-park.

It further found that engagement of fans was delayed until the engine is unable to provide external power during the initial stages of operation.

Also reported, the report maintains that ingestion of more than three seagulls during one minute causes the altitude to drop, since engine thrust is reduced when the propeller rotates uniformly for several seconds. Engine recovery after ingesting eight or more seagulls or two apparently irreparable.

No 737 propeller on the Eastern Electra was destroyed, the report stated. The manufacturer suggests that this engine was the first to be successfully fitted to bird ingestion and that at least four tools were required.

The Board found that No. 2 engine possibly ingested six birds and this was probably responsible for the damage. No. 3 engine ingested six birds. No. 4 engine apparently ingested fewer than either No. 1 or 2. Shortly after the accident, CAB recommended that FAA conduct a basic research program aimed at improving tolerance of all major engines to bird ingestion. FAA is continuing with the program.

House bill completed during Fiscal 1967. It indicated that because National Aeronautics and Space Administration and Defense Department were engaged in related programs, the transportation committee, in which the cut was partitioned.

Republican leaders insisted that the development of the aerospace transport be lagged under the Kennedy Administration, and will make the subject a national issue before now and the full congressional election (see p. 32).

The House also:

- Recommended FAAs spend \$45.5 million to operate the automated ATC system in Fiscal 1965. Although the agency had requested \$40.5 million of the \$45 million in the House requested a \$20.5 million increase over the Fiscal 1962 appropriation.
- Approved \$120 million for new facilities and equipment; the same amount appropriated in Fiscal 1962, and \$15 million less than FAAs budget on file.

House appropriations committee, in during FAAs civil aerospace transportation request to \$15.5 million, expressed hope that thoroughly studies of the aircraft

First  
in the world  
in automatic  
flight control\*



• 1996 年度新規開拓事業実績報告書

The venerable CG-4 will delivering a day's work for a day's pay—is a reminder of an era that is passing. Within a few years' time, transports will join today's fighters and add a totally new dimension to armament. All the armament in combat, natural as flight, will now be guided and controlled by Sperry. This means the untrained performance, the non-interpreting quality, the day-and-night reliability, which Sperry flight control systems have been

developing some strategic flight began. Sperry Phonics today has expanded its aircraft flight control systems for every class of aircraft: helicopters and transports along with fighters and intercontinental bombers. Light business aircraft along with high-performance military jets. Sperry developer-manufacturer *in the world* has experience in neck depth research to develop a customer.

Whether your own project is in the military, commercial business or private aviation field—no matter how difficult it may be to understand the specifications—you will be greatly aided by dealing with **SOURCE PHOTON**.

**SPERRY**

**SEVERN ENGINEERS INCORPORATED, DIVISION OF SEVERN BAND CORPORATION, PHOENIX, ARIZONA**



## The Long Arm of the Vulcan

Armed with the Aeron Blue-West stand-off assault, Britain's Mk 2.5 Southern can now patrol its targets without the hazard of risking the close-inboard air. It has had to learn from experience. Blue-West, powered by the British "Solid Jet," has since 1962 engaged in over 100 trials missions at speeds up to Mach 2.5, and is progressing.

The Humanistic Strategy using HTP and its outcome as pragmatics, is the most useful way of getting things I described at the E. Leslie's other paper for moral integration, his idea of having shared, or revising our principles stated by this stage of work probably not up to his genes himself has a different effect.

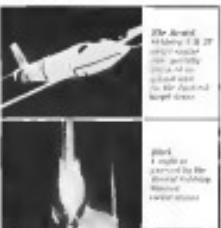
A feature of the Shetland as that its owners can be regarded as members of a wide range of new groups and clubs. An example of this is the Shetland Sheepdog Farmers' Club, a most popular canine for the Black Knugget goat research work. At competition each year there is a great deal of interest in the various dog competitions. Shetland Sheepdog

My strong recommendation of *person-centered* (Fager, Stevick and others) suggests that Neuhof's own preference of *directive* (or *directive* + *supportive*) techniques may be a source of confusion.

**BRISTOL SIDDELEY ENGINES LIMITED**

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**EX-10.6** *Software Development Toolkit - Video Engine - Sample - Index Page 1 of 1, This file contains no code, Toolkit, Media, Data and Information related to the video engine component.*



gister  
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Editorial Review

# Airline Income and Expenses—May 1962

IN BILLIONS

	Passenger Revenue	U. S. Mail	Freight	Profits	Charter	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
<b>DOMESTIC: 1962</b>								
American	24,731,318	924,712	479,463	3,413,373		38,875,070	38,507,726	364,307
United	8,356,573	371,269	214,054	359,361	57,312	9,096,449	9,023,845	493,605
Continental	4,300,000	171,000	44,000	45,000	45,000	5,920,000	5,850,000	70,000
Delta	12,347,890	323,000	184,208	343,850		14,710,059	13,494,749	2,215,110
Southern	25,363,413	899,654	510,207	1,361,207	130,320	38,875,441	37,115,849	7,761,592
Western	5,389,647	189,300	37,103	346,816	116,300	7,976,491	7,955,369	121,242
Trans World	2,389,000	100,000	28,807	343,850	100,000	3,732,850	3,675,000	57,850
Northwest	7,150,000	341,251	221,251	545,341	42,254	9,846,336	9,533,816	312,520
Trans World	17,713,899	331,000	184,000	1,364,845	116,811	20,875,749	19,575,210	3,300,539
United	16,807,273	1,484,374	2,145,000	3,111,201	311,201	38,875,041	37,429,546	4,445,495
World Air	6,156,179	180,000	317,413	32,384	8,400,000	8,260,000	240,000	240,000
<b>INT'L: 1962</b>								
American	834,049	9,183	308	47,797		847,046	172,899	-66,178
Trans World	833,073	2,379	216,279	14,355		845,035	132,510	-88,525
Caribbean Airlines	127,263	2,773	216,213	2,740		428,033	373,014	56,000
Delta	144,298	1,000	9,366	186,000		386,000	384,000	-4,000
Eastern	1,200,000	300,000	1,000	1,200,000		1,500,000	1,498,000	2,000
Midwest	121,461	449	3,933	1,247		147,941	132,046	15,895
World Air	1,764,000	837,000	305,567	911,000	4,378,000	8,446,000	783,478	
<b>PAN AMERICAN</b>								
American	383,360	14,200		42,827		489,800	379,610	-110,190
Air India	16,281,298	1,354,800	1,411,000	1,057,308	14,355	20,985,800	20,700,000	285,800
Delta Air Lines	8,318,000	345,000	1,200,000	1,200,000		14,500,000	9,912,000	4,588,000
Delta	7,707,000	1,000	1,411,000	1,411,000		19,100,000	19,000,000	100,000
Eastern	1,200,000	41,000	1,000	1,200,000		1,500,000	1,498,000	2,000
South Pacific	31,279			1,2487		36,497	33,181	3,316
Trans Caribbean	645,763	1,000	84,847	(2,813)		486,364	472,916	10,273
Trans World	1,094,504	115,000	1,200,000	1,200,000		2,397,187	2,187,231	210,956
World Air	1,352,201	314,800	97,337	2,398,000	31,000	4,069,493	382,655	3,687,845
World Air	1,352,201	314,800	97,337	2,398,000	31,000	4,069,493	382,655	3,687,845
<b>REGIONAL SERVICE</b>								
Air America	1,315,858	54,832	25,152	52,339	4,728	3,916,368	3,814,447	101,921
Frontier	310,324	4,387	3,223	9,299	51	875,439	871,446	51,993
Interstate	470,400	19,200	4,311	20,500		569,600	565,600	4,000
Interjet	590,000	1,000	2,000	2,407		1,314,000	1,314,010	33,519
Interjet Central	306,947	12,684	9,099	13,889	1,503	721,935	697,583	4,656
Midwest	1,435,671	32,732	27,100	36,256	65,000	5,016,920	5,012,746	12,174
North Central	291,203	18,000	15,072	22,015	1,000	784,029	780,029	4,000
North West	291,203	18,000	15,072	22,015	1,000	784,029	780,029	4,000
Peaks	931,014	15,165	4,166	16,762	1,200	446,375	445,875	-5,000
Perimeter	880,761	15,000	16,467	19,444	1,114,000	18,444,444	1,200,441	1,200,441
Trans World	1,094,504	115,000	1,200,000	1,200,000		2,397,187	2,187,231	210,956
Trans Texas	116,498	14,800	4,808	22,074	12,073	7,630,992	9,921,023	30,899
West Coast	411,397	15,007	3,158	15,905	4,400	4,069,493	382,655	3,687,845
<b>OVERSEAS: 1962</b>								
Air France	494,910	3,861		8,110		417,071	993,447	-572,329
Aerolineas Argentinas	472,052	100,816		484,929	801	476,748		
<b>CARGO: 1962</b>								
Flying Tiger	976,390					4,730,390	4,166,413	535,877
Trans World	278,407					919,159	1,000,440	-12,281
U.S.						1,000,441	1,000,441	0
<b>HIGHLIGHTS: 1962</b>								
Airline Holdings	44,324	245,484	1,207			4,111,171	167,339	3,944,073
Delta	16,049	15,298	15,485			2,412,000	2,412,000	0
Nor. Pacific	106,122	901	2,036	3,207		32,006	31,255	7,572
<b>AIRLINE LINEUP</b>								
American	12,712	8,467		15,441		56,997	10,934	174,201
Continental	18,048	316		2,412	8,011	20,229	21,598	-1,369
Delta	120,659	79,315	34,904	1,207		2,412,000	2,412,000	0
Frontier	1,200,000	1,000	1,000	1,200,000		1,200,000	1,200,000	100,000
Interjet	100,000	1,000	1,000	1,000		1,000,000	1,000,000	100,000
Midwest	1,435,671	32,732	27,100	36,256	65,000	5,016,920	5,012,746	12,174
Perimeter	880,761	15,000	16,467	19,444	1,114,000	18,444,444	1,200,441	1,200,441
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West Coast	411,397	15,007	3,158	15,905	4,400	4,069,493	382,655	3,687,845
World Air	117,199	10,476		44,464	120,379	488,679	495,191	5,916

These figures reflect the average shipping and freight movement by operating companies. Includes coastal shipping. Figures for Alaska, Hawaii, Canada, Mexico and American Samoa.

# AIRLINE OBSERVER

►First draft of White House study on a U.S. international aviation policy has been completed on schedule and is now being reviewed by the State Dept. No final report will be issued until the administration has established officials under a confidential classification. Government sources say the 400-page study was altered to remove the White House staffing committee at the end of last week. Final draft is to be completed by Aug. 27.

►Plans to formally settle a bilateral agreement between U.S. and Russia for a New York-Moscow route have been virtually abandoned by the U.S. despite Moscow's continuing strong desire to launch the service. U.S. is not viewing the pact as a formal economic agreement, but is considering the issues in a political light and does not want to exchange with the Soviet Union the rights and privileges provided in a bilateral deal as long as the cold war threatens to turn hot, as in Berlin.

►Watch for British European Airways to draw down its financial reserves in case of fuel losses for the fiscal year ended Mar. 31, which will total about \$7 million. The other transatlantic airline, British Overseas Airways Corp., will spend a total of about \$10 million. BOAC's 1968 will be the first in eight years. The company may introduce an additional sales program, reducing the spending of 62 million pounds to cover the financial constraint, in a move to boost the current fuel rate's gross revenue by 7% over last year.

►Passenger traffic on the North Atlantic increased 11.4% in June compared with the same month last year, according to the International Air Transport Assn. Available seats increased 14.0% during the same period and average load factor for the 18 IATA member carriers rose 2% to reach 54.9%.

►All civilian aviation flights in continental U.S. and Canada will cease during the U.S. bicentennial, July 4, as a military exercise to test air defense systems, which will be held from 7 p.m. and 9:30 p.m. EDT Sept. 2. Flights will not be restricted in the shutdown, but civilian flights will be grounded for 31 hours beginning at 7 p.m.

►Preliminary statistics compiled by International Civil Aviation Organization indicate that the world's airlines, excluding those in Russia and Red China, will show an operating loss of \$340 million for 1968 compared with 1967's operating profit of \$70 million.

►Russia last April 12 placed bipolar, designed by O. K. Antonov (AV 14), 23, p. 70, but since carried its 21 million passenger and cargo, the Soviet propaganda spotlight from Russia's highly touted technical and technological transports. In fact, in publishing the plane which has been in scheduled service for more than 12 years, termed it "indispensable as a source of passenger and cargo transportation in hard-to-reach places without ground conflicts in a crop duster, and for aerial photography and air survey work."

►U.S. Conference of Mayors, meeting last week in Washington, D.C., asked Congress to pass legislation that would give the Federal Aviation Agency authority to prevent aircraft and engine manufacturers and operating contractors that would manufacture jet noise.

►United Air Lines has received approval from FAA to extend the禁令 between overhauls on the following Pratt & Whitney engines: JT4A-6 from 2,500 hr. to 2,700 hr.; JT4A-3T from 2,400 hr. to 2,600 hr.; JT4D-6 from 1,800 hr. to 2,600 hr.

►Both Hawaiian Airlines and Aloha Airlines will appeal to the state's superior court a Florida Public Utilities Commission decision to withdraw a utility service in direct competition with the two inter-island carriers at rates 40% below standard fares. Island Airlines was granted the new franchise, while Aloha will serve by Alaska and Hawaiian. Ted is a second airline, Aloha Airlines, will stand by the commission. The commission holds that the Civil Aeronautics Board has no jurisdiction on intra-state scheduled operations but the two major airlines agree that federal, not state, agencies have jurisdiction over the channels between the islands.

## SHORTLINES

►American Airlines first week began experimental telephone service on two of its Convair 990s operating in the New York Chicago-San Louis route. American, in cooperation with American Telephone and Telegraph Co., plan to expand the service if passenger reaction is favorable. Thus, Ward Adams is also experimenting with telephones (AVW July 30).

►Plans to formally settle a bilateral agreement between U.S. and Russia for a New York-Moscow route have been virtually abandoned by the U.S. despite Moscow's continuing strong desire to launch the service. U.S. is not viewing the pact as a formal economic agreement, but is considering the issues in a political light and does not want to exchange with the Soviet Union the rights and privileges provided in a bilateral deal as long as the cold war threatens to turn hot, as in Berlin.

►British West Indian Airways recorded a 7% increase in passenger enroute between New York and major Caribbean islands during the January-June period, as compared with the same period last year. The greater enroute market was 6.7% up in traffic to Antigua.

►El Al Israel Airlines ended a profit of \$218 million for the fiscal year ended Mar. 31 by a month earlier than in 1967 service. During the same period El Al's transportation of 171,800 passengers represented a 58% increase over the previous year. El Al also noted that it had a 33% load factor on the Atlanta route, compared with the average 51.2% for all inflight on the route.

►Hawley Page has formed a leasing company to charter aircraft. Dan Hawley, chairman, marketing director of Hawley Page, separates off the production line, Hawley Page, to permit continuous liaison experience with the aircraft before taking delivery.

►Swiss Air Lines, plans to place four Convair jets in service on May 1 throughout its European network, linking Madrid, London, Paris, Zurich, Rome, and Frankfurt. Two additional Convairs will be added as early summer.

►International Civil Aviation Organization reported that its Assembly will meet for about two weeks in Rome beginning Aug. 22. Pending the meeting will be to review ICAO's role in the field of air navigation and transport, to harmonize air law and technical standards, and to plan future projects.

►Pan American World Airways and its scheduled 126 jet flights a week to accommodate traffic during the fall and winter months on its transatlantic routes. This will represent a 31.5% increase over the same period last year.

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York, Radio, Products Aerospace, Research. The program is involved in the definition and analysis, evaluation, integration and production of subsystems for space navigation and stabilization, with technical direction and management furnished by the Ecliptic-Pioneer Division.

For more detailed and more specific information on the program, write: Space Navigation Program Office, The BENDIX Corporation, Teterboro, New Jersey.

Or, just dial 201-371-2000.

Space Navigation Program



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# MANAGEMENT



WEST GERMAN AIR FORCE F-104 Super Starfighter is shown shortly after roll-out from the assembly line at Münsterling. In the background is a German Air Force Fugger Magister built by Messerschmitt and assembled at Münsterling.

## F-104G Consortium Struggles to Overcome

By Carl Breslow

Europe—European consortium production of the advanced fighter aircraft, all under Lockheed F-104G in leading the U.S. and European governments' joint efforts that participation will provide valuable guidelines for the future.

If this does not occur soon enough by the U.S. industry within Europe, problems will be even more difficult to solve in the face of this contract's improved technology and sophistication on the one hand, and the German Minister's anticipated tariff increases against U.S. aviation products as the other.

Caught in the web of climbing costs, political technological dictate, the inherent inexperience of a number of the partners in complex aerospace programs and of the 5 percent increase in manufacturing overheads, the European partners in the consortium, the productive program and aircraft alike often have appeared to be on the brink of failure.

The West German defense ministry funds poor quality, material damage, shortage of spares and long lead times—and the fact that the aircraft will never attain all the performance goals set out in its contract had now turned it toward another one European company to another one government in the west, with the first flight originally or originally, generally failing back to U.S. prime contractor and the U.S. government.

Much of this is perhaps inevitable, regardless of how the program might

have been conceived, presented and managed. The project itself is an enormous one, justified and highly favored in West Germany, in an effort to break the gap in its post-war technological base, and also, says the Belgian, British and French somewhat reluctantly, in that case.

The overall cost was placed at about \$2 billion, but actually kept increasing from the original estimates of manufacturing more than \$1 billion.

Much of the increase has been funded into research and development costs which the Germans had not fully anticipated.

Allied funds or user advances have been almost exhausted. Defense Ministers already openly fear because of the increased costs and a number of nations have understandably chosen to approach their respective preferences for their aircraft.

Still another factor is the tendency to some quantum in regard the F-104, as such, as an existing aircraft, with an additional commitment to prove it as an all-weather interceptor strike fighter and reconnaissance aircraft, is potentially a new, tough untried weapon system.

Responsible European government officials generally acknowledge that but add that they were led by U.S. government officials to believe that a sum of the modifications would make relatively small cuts in the aircraft.

The resulting growing-project costs and cost-cutting changes have largely obscured one major point: that is now emerging in the program's favor:

Partnership members have had to be broken. Major credits will need to be made, anticipated profits in U.S. firms have shrunk, but the program is getting respectable sales in original schedule.

Netherlands (Delft) and Belgium (Antwerp) are still the white dogs, though, as the others "stick to us like glue connected with the program since its inception."

The Germans were cut to the bone, 15 years of technology with no sign of the effort involved. The U.S. contractors thought there could handle this like any other license program in the past and did little assistance, to boot. Black was a bit more." This seems to be the general verdict.

Airframes, engines and, to a more limited extent, avionic systems are beginning to roll off Belgian production lines, but reports, for the moment, that has built up will be difficult to bear down.

The U.S. firms involved are now pulling the effort, however, with a strong assist from the U.S. Air Force to reach them as well as in European markets by degree, rate company funds to keep the program moving.

Discerning West German officials indicate U.S. production lines, the four European nations involved in the aircraft and build a total of 949 F-104Gs and 1000 components by 1965. Initial assembly at U.S. provided parts got under way so the lead plants early last year. Of the projected number of planes, 604 are scheduled to go to the German air

force, 125 to Italy, 120 to The Netherlands and 100 to Belgium.

Under original scheduling had done more than two years ago, 106 aircraft should have been built and/or assembled by the European companies by July 1, 1962. To date, a total of 82 had been rolled out as well as the cargo of completion.

At the end of the year, the original

schedule had programmed completion of 240 aircraft. Present projections with production into double building at the Dutch will have been completed by that time.

As an indicator of the growing difficulties in the program, an accompanying agency—the NATO Starfighter Management Office (NAMO)—has informed responsible North Atlantic Treaty Organization officials that production will be on schedule during the course of 1963. It adds, however, that the consortium partners had had

\* Southern Group, consisting of MacDonnell Douglas, Doncasters and Sestrel, the firm to go into production of all aircraft, plus 15 recorded from Lockheed, respectively, and passed through final assembly and fuel load has been deferred to the West Germans as late. Production rate, thus, as planned started, may well be slightly better than the scheduled to get month. By the end of the year, 67 aircraft should be completed. Total production for the Southern Group will be 284 aircraft, of them for the West German air force.

\* February 1961—USAF signs sole for MacDonnell Douglas F-104Gs.  
\* June 1962—West German signs license production contract.  
\* July 1962—Belgian signs license production contract.  
\* Sept. 27, 1962—Czechoslovak signs license production contract.  
\* Sept. 27, 1962—West German signs license production contract.  
\* April 20, 1963—The Netherlands signs license production contract.  
\* June 20, 1963—Belgian signs license production contract.  
\* February 1964—USAF signs sole for MacDonnell Douglas F-104Gs.  
\* June 1962—MAP signs additional MAP F-104Gs.

sold, have been converted and 39 are flying as new in fabrication. Delft, with a flexible contract, is responsible for final assembly and flight test.

\* Western Group, composed of Belgium's Socite Anonyme Belge de Construction Aerospatiale (SABA) and Avions Fairey-Fox aircraft unit from Lockheed parts, had passed through final assembly. Delft at all five in the West German air force appeared imminent.

The group brought one complete aircraft from Lockheed plan 14 to shock down assembly to build up experience in the aircraft production stages. Total production for the Western Group, under present planning, will be 159 aircraft for Belgium, 39 for West Germany, and, if present planning will be 159 aircraft for Belgium, 39 for West Germany. Testing within the group is 90 percent complete; 92% of the aircraft required for the 189 planes in on order and 75 percent are in fabrication. SABA is responsible for final assembly and flight test.

\* Italian Group, composed of Fiat, Macchi Avionica, SIA Marchetti,



## Difficulties in Management

### F-104G Contracting Milestones

- Feb. 8, 1959—West Germany signs contract for development of the F-104G.
- May 18, 1960—West Germany signs contract for licensed production.
- Sept. 27, 1962—Czechoslovak signs license production contract.
- June 20, 1962—Belgian signs license production contract.\*
- April 20, 1963—The Netherlands signs license production contract.
- June 20, 1963—Belgian signs license production contract.
- February 1964—USAF signs sole for MacDonnell Douglas F-104Gs.
- June 1962—MAP signs additional MAP F-104Gs.

\* Canadian and Japanese versions may encounter liaison the European market, primarily in private stores to adapt them to the specific missions planned for the market by the user nation. MAP aircraft also will be confined to some extent



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GENERAL ELECTRIC



DORMER ENGINEERS use E-11HC and bridge sections left, sitting at Matsushita plant. Right, Super Starfighter forward fuselage panels are kenned at the Vickers-Armstrongs plant in Brough. Open bay at air end on home M-68 Vinton engine.



Puglia, Aerles and SACA, the last to join the consortium—six aircraft built with Lockheed components, had gone through final assembly and was in flight test. The group purchased two more aircraft from Lockheed plus 19 others in knock-down assemblies. Total Italian production will be 200 aircraft, 125 for Italy, 50 for Germany and 25 for the Dutch. During 1970, production will be 70% of the initial capacity for the 125 aircraft, 10 under and 40 to Italian contractors. It is responsible for final assembly and flight test.

In addition to roles from the European consortium, the West Germans are building their force through the purchase of 96 G models directly from the Lockheed line at Berlin, Calif. Of these, 71 have been delivered, 10 all going into the air force's first combat wing that was commissioned on June 20, the date originally specified. The Lockheed program however is also slightly behind schedule. The line of the aircraft in Germany is to be at Germany by the end of the year, Europe by 1972, and the rest of the world by 1974. The first flight of the first aircraft is scheduled for October 1971.

A major delivery drawback has been flight acceptance, with the outcome overthrowing the aircraft's capability of performing its three-grade mission with out fault or compromise. That it will never do, and nor can it ever accomplish with the program now planned that it will. The overall concept, they say, demands compromise on some points.

"We are official odds," the aircraft team set out to be a good aircraft—and I don't mean an optimum aircraft—we have taken a long step toward. We just haven't reached the state of the art where one plane can do all those things perfectly."

Despite over and out what the D could should be capable of doing and what will be planned retrofits to the aircraft and, when we found out about it, the feeling was better." This fact also has raised ribs among the Europeans partners. In fact, the last member to enter the fold, reportedly compromised just at barely when the work was redistributed on the Euro-Hawk program. It is compliant. Also, there is little to no cross-over technology between the two aircraft programs assigned to Hirschfeld into the program's flow diagram, which would have represented little or no work for either industry.

• **Flight production quality control.** Guidelines from our supplier for European assembly.

• **Alleged glossing over** of the ground-support requirements in terms of service equipment, boxes, etc. Germans who may expect little or no writing in event of stuck from across their customs border have perhaps been disturbed to find that their power equipment must be up to 100-watts to fight the self-start requirement. Sounds like some excuse for not taking care of the checklist of the aircraft's 17 major avionic systems has been under way for the past several months, with a number of U.S. engineers ongoing back.

A basic problem is that, except for the Matsushita-Brownell amputate the system as a whole were not designed for automatic checkout equipment, and no units are provided to accommodate such tests.

The U.S. firm goes, in the words of one spokesman, "that they are not blameless." The criticism of the three short comings is to the point that they also believed experience during the initial phases in implying a technical import problem of such importance.

As to the charge that the Europeans are not told of the research and development work still required, one Poston official commented with the program, who she stressed of some aspects of the U.S. industry's performance—was

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the Europeans talked over the wire that will stay with us well after they lose the plane going to land to make repairs. They didn't want to think about it, either."

#### Technological Jump

Another participant in the program likes the noninterchangeability length of the quantum technological jump required of the European firms, particularly in Germany where companies were faced with the necessity of adapting almost overnight from British practice of using simple Flange-Magnetic actuator to the complex F164C. He says:

"When we were into production on a program while it is off the development stage, for us, was the case with the F164C because of the problem of what German firms represented, they are going to be roughly. We expect it as a matter of partner in the U.S. Air Force, because we've been through this in the past."

"This is the first time these people have experienced anything like this, this kind of program enough times for it, and there's always a lot understandable. I don't blame them, he continues.

The Europeans, another oddy, reported as to get them the drawings and that would be it.

"There's no place in the world that's set up in accept changes. This is going to be tough."

Still another participant complains that, in the initial stages, some of the European contractors were so persistent in overwriting and in accepting the drawings and specifications as they then stood. He says:

"They didn't want to believe that they might need some help in interpreting them or translating them into hardware. They wanted us to hand over the drawings, tip our hats and leave."

#### Quality Control

U.S. contractors also agree that there have been instances of poor quality control, both in complete system built in America and components shipped in Europe for assembly there. This, in turn, has had that effect of bringing over the state of quality control within most European manufacturing areas. They attribute a substantial portion of their own mistakes, as well as those within Europe, to the rapid production schedules in the early stages plus an incorporated subsequent need for more and more U.S. items to keep the European program moving.

They contend, however, that the improvements of quality control ratios have been shown out of proportion in the initial drawing that have done to the programs.

"In a complicated system like this,"

one says, "there's going to be different parts that get through. This isn't the Mi-10, and it's another hard lesson that we're going through. They live as though each individual item is going to work 100%."

In one instance, at least, a European contractor is making a change of the name, an acronym of the delivery parts it had named that had earlier proved problematic in the U.S. review. It denoted in front of the Latin translation. After that review, it was concluded by a meeting top official of the U.S. government that the internal configurations were to be sold the number of defense parts has since declined appreciably.



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### 13460 UNDERWING REFUELING NOZZLE

**LIGHTWEIGHT.** Aluminum. Weighs 10 lbs. Internal metal parts are non-corrosive stainless steel or aluminum bronze.

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**FAST.** Twist to engage. Push lever just 40° to lock on. Delivers 600 gpm, with pressure drop of less than 8 ps.

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In the table above, we have given you typical example of the composition control we can maintain in melt after melt. The alloy is the one illustrated in the photomicrograph - Udimet A, a Mar-Aging type high strength steel.



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progress at a whole new level for the parts with its four square grooves, but assure the electron-beam and vapor concentrations in each.

Following as the "bay technology" philosophy, each contract has demanded that at least one fixture, within its bonded status in place of the final assembly as well as component production of the initial NASA/RRL fan control system and the F104G's 15,000 lb thrust General Electric 179.7 aircraft propellant. Until such time comes with its own standards plus those supplied from the U.S., are shipped from one nation to the other in a commercial envelope and give the partners experience in dealing with both.

"We had to let our contractor know that a U.S. office in Washington oversees," the GAD (General Accounting Office) would try to put us in our business.

As an example, here's the planned production hypothesis for the critical data 41 nozzle transverse designation, F15A, of the NASA/RRL fan control system designed for the aircraft, with each country retaining its share of fuel fluid production and authority to manufacture parts from the other partners involved.

■ Germany's Telefunken-Gefäß-producers, with its subcontractors, of the nozzles and the intermediate frequencies, part supplier for all four nozzles.

■ Holland's N.V. Holland Signaal-apparatuur (SIGNAAL) - producer with subcontractors, of the witness and reactor load sensors, computer, flexible waveguide, waveguide switch and driver, code.

■ Belgium's Manufacture Belge de Louage et de Matériel Électromécanique (M.U.M.E.) - producers, with subcontractors, of the indicator radar, computer (order a SIGNAAL subcontractor), the low voltage power supply and the electronic control computer.

■ Italy's Fabbrica Italiana Apparecchi Radio (F.I.A.R.) - producers with subcontractors, of the microwave electronic components, which are turned for waveguide coupling, circulator, phase shifter, and radio control.

The longest lead time required 190 sets from North America's Aerospace Division and are in the process of checking that out prior to customer shipment. Next step will be to put North American-supplied units together, then the assembly of individual blocks, boxes and component enclosures, and finally, the construction of the units themselves from the ground up.

The intention for the GE 179 powerplant, although providing considerably less heat than the nuclear, is substantially the same.

Of the three firms involved, all have a fast, friendly and efficient quality and all three are producing parts that will find their way into each engin-

that comes off the respective lines.

With the 144 knock-down engines supplied by General Electric from the U.S. to go the program under way and accelerate the initial learning curve in place of the total, Germany's BMW (Turbojetwerk Greifswald) and its subcontractors are responsible for the final assembly of 612 generators, Belgian TN worth for 314 and Fiat for 312. No Dutch firms are involved in joint ventures.

So far, the program is on schedule, and there appear to be no serious difficulties for the future. As of July 1, 210 of the powerplants had been assembled, 104 in Europe.

The engine is a knock-down replacement of the space-age press series of the other participants do, one subcontractor says. "These components have been getting much for years and they're good as it. They've tested with turbine engines before and then knew what they are doing."

Slowly, other production and deliveries are coming along.

Luton Industries and its European substation has done well over these 190 external navigation platforms to date and we scheduled to reach about 460 by the end of the year. International Telephone & Telegraph Corp. and its European subcontractor Standard Elektrik Lorenz, however, appears slightly slower. There seem to be 440 such in Joe 3.

So far, after minor problems and well sorted out, are beginning to move, the program after a number of false starts is under way.

"We still believe," one contractor admits, "but now we think it's going to go."

This is the first of two articles detailing the problems confronting, and the progress made in the enormous F104S aircraft production program in Europe. Specific features of the aircraft will be covered in the second article, which will detail the design, procurement, and financial aspects of the flight test and early production projects, aircraft to U.S. 5 free-hike sites to keep the program moving and the general outlook in Europe will be discussed in detail in the final Avenue West article.

#### Soviet Hydrofoils

Moscow-Soviet Press has learned its first long, narrow, pointed, all-welded hydrofoil boat built by the Krasnoyarsk plant at Golov, the result is called the Vika (Whale).

The Vika will be able to surpass the 300 passengers in class boats. It has hydrofoils originally designed for use in moderately rough seas. Maximum speed about 10 mph.

Russia has the pronounced fact of a hydrofoil boat as a research craft.

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# AERONAUTICAL ENGINEERING



Front view of the North American AH-2 initial test article shows long fuel additive tank below cockpit.

## First Photos Show Long Range, Reconnaissance



Prototype of AH-2 (above and below) has four-bladed navigator's windscreen blind area. Evolution version will reduce it. Landing approach (below and bottom opposite page) shows large flaps on wing trailing edge. Note change in deflection of slat tail during touchdown.



Top view of AH-2 in attack concept, shows belly fairing for addition of tactical reconnaissance gear.

## A3J Versions

Two new versions of the North American A3J Vigilante are undergoing development and test under a \$37 million Bureau of Naval Weapons contract. The AH-2 test pilot crew (top p. 83) is a longer range version of the A3J with added fuel stored in an aerodynamically integrated boom behind the horizontal stabilizer component. The A3J (top p. 83) shown in attack concept, is a reconnaissance version and based on both a set of the few external modifications. In the AH-2, leading edge flap extensions for the added fuel weight are transferred to the central fuselage and added to the forward wing surface as well as the side section on the A3J. The AH-3 will article these wing modifications also.



Additional attachment for droppable fuel tank on each AH-2 wing.

Prototype AH-2 approaches touchdown with leading and trailing edge flaps extended. Only one prototype is planned for the program. Follow-on aircraft are referred to as test articles and will become part of the military inventory at the conclusion of testing.





CURTIS-WRIGHT Model X-100 testbed tested 215 hr test time in ground, in tether and in flight with company and NASA pilots.

## X-19 VTOL Proposed for Wide Application

By David A. Andrusin

**Coldwell, N.J.**—Two Curtiss-Wright Corp. X-19 VTOL research aircraft being developed under contract to Air Force Systems Command will allow only minor changes from the Model 100 aircraft design and parasite built with existing tools.

Small increases in fuselage length and the addition of some external equipment will make the difference between the Model 200 and the X-19. Test of the two is approximately 55% completed and the second is about one-third finished. Because of this advanced state of development, delivery of the aircraft is scheduled for mid-1965.

Total funding for the contract as proposed is \$5 million, exclusive of the studies already begun by Curtiss Wright. The Air Force contract is to be managed by North American Aviation Division and is part of the firm's broader VTOL program. This makes the X-19 the third heavier VTOL aircraft designed; the other two are the Bell-Yakovlev tilt-wing design primarily for Army, and the Navy's experimental heavier Bell and Douglas for a dual-role aircraft.

The X-19 is powered by a pair of Lycoming T53-L-9 turboshaft engines each developing 2,200 hp, in military rating. They drive four tilting propellers mounted in nacelles at the tips of two low-wing cantilever struts.

Each engine and propeller is thus tilted in a combination of differential propeller pitch and aerodynamic surface controls. Differential thrust control is phased out at the airframe limit of 10° roll in forward flight, and maximum 10° in both vertical and horizontal planes of flight. The differential pitch control is 10° pitch for forward and 45° pitch above 60% of the gross weight and the nose wing about 40°.

Current design gross weight is 12,100 lb, including 500 lb of payload or allowance for the crew. Speed for best range/cruising altitude at 731 mst is 100% including 10% fuel savings and 5% increase in engine fuel consumption over the specifications figures at 100% use allowed. Maximum speed is level flight at 17,300 ft at 400 hr max endurance.

### X-19 Application

Designs of the X-19 have applied its basic layout to a variety of other aircraft designs of larger and smaller size. One repeat paper study at a low cost VSTOL transport powered by two Lycoming T53 in General Electric T64 engines has this capacities. It would have a 500- to 1500-cu-in cargo space over a range of 1,000 to 1,700 mi at 100% use allowed, plus a 500-hr max endurance. At 100% use allowed, it is 6,000 lb.

All these missions can be performed with single-engine roll-off and landing capability as well. Cabin pressurized for altitude performance.

An X-19 is expected to have a gross weight of 10,000 to 10,000 kg depending on the loading conditions. Overall length is 15.8 m, width is 5.15 m, and height is 3.84 m. Cargo space is 6.5 ft. by 7.5 ft. by 10 ft.

control is handled by a combination of differential propeller pitch and aerodynamic surface controls. Differential thrust control is phased out at the airframe limit of 10° roll in forward flight, and maximum 10° in both vertical and horizontal planes of flight. The differential pitch control is 10° pitch for forward and 45° pitch above 60% of the gross weight and the nose wing about 40°.

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X-19 MOCKUP has enlarged canopy for better visibility. Canopy rear door will be replaced by longitudinal fairing.

## to USAF Role

for aircraft, an engine failure would mean opening the throttle to the stops to restore the original power level. Cruise flight in about 10% power from both engines, so that long engine life is an expected dividend.

Other claims for the design include the following:

- Controlled landing could be made even if one propeller were lost.
- Stall-free transition with power on.
- If the power tilting system failed, the propeller can be cranked up to 10° to a tilt angle of 20 deg, and a normal landing can be made at 100 ft.

Propelled takeoff, like other than that of a simple straight-tail road sled, is the key to the aircraft's unique features.

Maximum stress on the propellers is no higher than the stresses experienced during takeoffs in the old Boeing-Stearman-type propellers.

### Long Way

A commitment of the contractor which will provide \$1.8 million for the work to date is the remainder of the calendar year, even after a long period of financing starting in the Curtiss design and development team headed by Joseph M. Menges, now deceased.

The design was begun early in 1958 and after progressing through development and logic testing of the Model X-100 testbed, this was followed by construction. But in technical problems that plagued Curtiss

Wright a few years back, plus a lack of large production orders, left the company with a limited amount of risk capital. Management was reluctant to invest any more money into the program, even though it was close to completion of test aircraft, so that long engine life was an expected dividend.

The contract has advantages for both parties. The Air Force gets a pair of test vehicles for much less than it could possibly have bought them starting from scratch, and Curtiss-Wright gets to build the plane and hopefully to prove once and for all the different principles of lift and propulsion that make its design unique.

This different principle is the application of the solid disc produced by propellers designed to take maximum advantage of the available air. In comparison with the sheet of energy developed and the lift of the wing, this solid disc fills the gap of the wing. This solid disc period when thrust is decreasing and drag lift hasn't yet built up to a value to sustain lift.

Advantages of the configuration are complex, in a generic way, and the interaction of the propellers for flow starts with those of the side wings produce a favorable aerodynamic configuration which the geometry looks completely unfathomable. One example of this is the entry at a high angle of propeller tilt, the wing starts to lift at about 30° to 40° because the transition velocity increases rapidly to 100 ft.

Base load control with the roll control principle is applied to the Curtiss-Wright VTOL studies was performed at

the Ames Research Laboratory of the National Aeronautics and Space Administration. Propellor aircraft performance and stability from wind tunnel made in the laboratories of the Massachusetts Institute of Technology.

This test work was applied to the development of a two-propeller test vehicle, the Model X-100, which has a total of 214 hr at the hands of company and NASA pilots in ground, tether and flight tests.

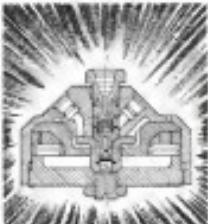
More than 2,000 hr of wind tunnel work on the Model X-100 design were completed at AMF, pounds in aircraft performance and stability. Flight test of the X-100 has verified the performance of the propellers.

### Mockup Interior

Mockups of the X-19 is built with a transport interior rating in addition to the crew, the capacity of the X-19 is such that the interior can be laid out for 10 troops in an assault transport mission, or for other combinations of crew and medical patients, mobile site arrays, or other rear tasks that may confront military planners.

One major change has been made in the mockup, modifying the windshield shape from a gently slant to a steeper angle to improve a cabin's crossflow. Entering at the rear of the aircraft will be walked from its present dimensions of 25 in. by 42 in. This allows a seat which can be much more comfortable for long operations in a tensile or lateral role.

Pilot's cockpit in the mockup and in



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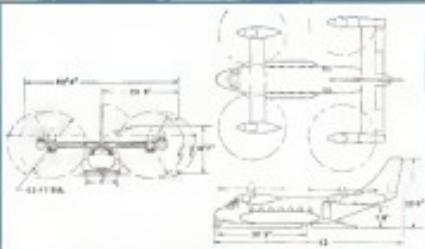
## **REGULATORS for**

The Model 8000 has the following eight levels of springs from conventional coil-spring designs (1) relatively small to a mid-range, (ii) economy and durability (3) low-resonance damping requires around twice permitting use of very narrow number of parts. This provides high degree of safety by (4) normal resonance damping, (v) certain types

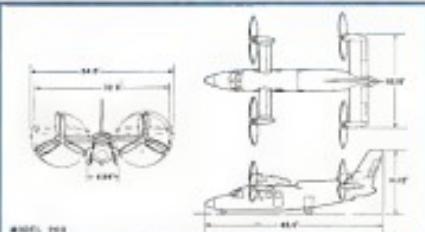
Логотип

The logo for Frebank Company features the word "FREBANK" in a bold, sans-serif font. The letters are partially obscured by three stylized, downward-pointing chevrons or arrows that are slanted to the right. Below the main text, the word "COMPANY" is written in a smaller, all-caps, sans-serif font.

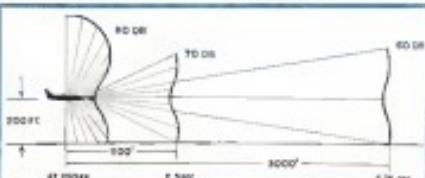
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The following chart shows regional distribution of Castro Brothers' NAB.



**CALCULATED NOISE LEVEL** criteria developed by Curtis Wright are based on job

The first experimental attempt is planned with a conventional set of controls for the right-seat occupant, and a helicopter engineer and the Air Force hope to find the best system after four flights have been made.

Recovery of the concept is common and standard in literature. There are no real ways to reconstruct probability, the first being an algorithm by Knuth and Merges—but otherwise the reader is completely

This combination of control systems is frankly environmental, and both the left seat, so that beginning pilots will not feel too strange.



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#### EVEN ON TURBINE ENGINES

Detailed, exacting visual inspection of Dart flame tubes is used to find cracked cooling rings, loose nests and other discrepancies. The inspection is very precise — and very honest, for the flame tube is as vital to turbine engine life as cylinder condition is to piston

The cylinders, flame tubes, are normally good for more than one operating cycle. If they are defective, they are repaired in the shipwork shops, using modern methods for handling high temperature metals.

If necessary, the flame tube is sectioned on a lathe, and a new center section added.

Then the tube is re-welded under a blanket of argon gas to prevent oxidation of the sophisticated metal at high temperatures.

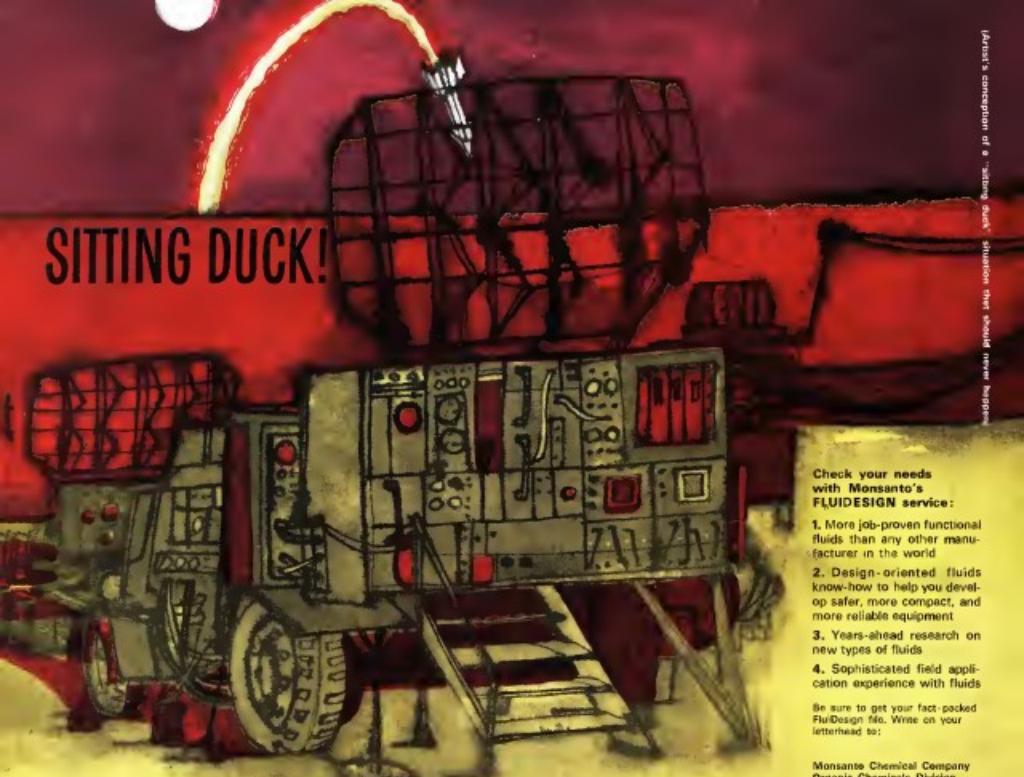
The volume of Dart engines handled by the Airwork shops, justifies the best available test and rework equipment. But, in many cases, the best test equipment available is still the honest craftsmanship of well qualified inspectors, working for a company with a long tradition of quality. We offer you this at Airwork... and back it with the trouble-free experience of our many turbines and piston-engine customers. Write for our brochure, "Essential Aviation Services".



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X-19 LIFTS OUT of an unprepared field in artist's conception, with nacelles tilting forward to start the transition.

structure to accommodate these seats. For this AVIATION WEEK reporter, the only drawback was a low fuselage height, necessitating a well-bent back in getting in and out. But once in the cockpit, the seats were comfortable, there was plenty of leg and arm room, and the seat adjustment range was more than was necessary in both the fore-and-aft and up-and-down directions.

Two standard queries are posed to every proponent of VTOL designs: first, what about the outflow velocity under the lowering aircraft; and second, what about the noise level?

Tests made comparing the Model X-100 test vehicle to the Hiller HJ-12 helicopter showed that the X-100 outflow velocity was less than that of the helicopter at distances greater than

about 25 ft. from the centerline of the aircraft. Typical difference was about 10 mph. Toward the center of the flow area, the velocity increases for the X-100, compared with the helicopter, with a substantial incremental velocity change to the X-100. These latter values were computed by momentum theory.

Curtiss-Wright says the aircraft is inherently quiet, with powerplant noise masked in the low propeller noise level. Residual fanlet level is low because of the exhaust velocities being low and the fan exit noise. The exhaust noise of the engines is also low. Intake noise and feeds a plenum chamber, that and the configuration should combine to minimize compressor noise ahead of the engines.

The company emphasizes that the X-19 is basically an airplane that has VTOL capability, and points out a half-dozen missions that a developed aircraft of this type could perform: surveillance, anti-submarine warfare, reserve, liaison, light transport and low-level attack. Some of the claims advanced for superiority in these missions depend on verification of the principle of flight and the realized advantages, but others can be considered inherent in the aircraft.

For example, the wing loading of the aircraft is high, which is a known desirable characteristic for low-level, high-speed flight. High wing-loading values minimize turbulence and give some gust alleviation under these conditions.



#### Army Studies HU-1 Amphibious Capability

Floot gear for Bell UH-1 series helicopters will be evaluated by U.S. Army. Floats, made by Air Cruisers Division of Garrett Corp., are 20 ft. long and have a 33-in. dia. with a total displacement of 113 cu. ft. per pair. Weight is approximately 350 lb.



## INSTRUMENTATION FROM CEC

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## PRODUCTION BRIEFING

Korean Aircraft Corp. has completed a flight evaluation of the Liouling T53-9 engine in a standard H-11B helicopter built under the Air Force Contract. The engine is fully competitive and provides increased performance and range. Korean is proposing adoption of the engine in some future H-11B aircraft. At present, the T53-9 engine is the only one currently in production.

Six Air Force Academy students aged 18 to 22 completed 35 days working as a team in a simulated crew environment of a space vehicle at Lockheed Marconi Corp. on June 24. Air Force announced recently that first analysis of the experiment indicated that a crew could perform well on a space mission.

Martin Co. has been awarded a National Armaments and Space Administration contract to prepare a heat shield, boom and thermal insulating orbital equipment.

Used Technology Corp. has entered a \$337,190 USAF contract to conduct research in non-destructive testing techniques for large solid-propellant rocket motors, including grain ultrasonics, vibration, vibration and acoustic testing.

Long Beach-Vought KODU-1, larger, more flight-ready version of the Raytheon 2 graded ramjet will be used by the Navy at Rensselaer Roads, Puerto



C-141 Forging

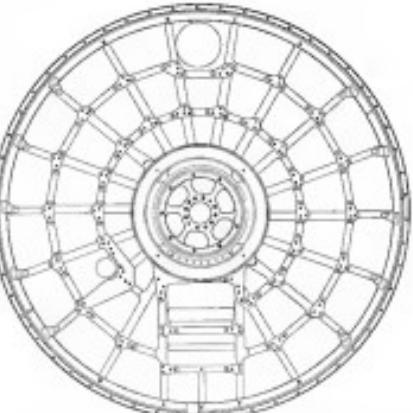
Massachusetts' Lockheed International Inc., with offices over a 2,700 sq. m. part of one mile behind its Lockheed C-141 Highspeed long-haul jet at Georgia Division (AW Oct. 7 p. 59) is shown after being pressed from a billet at Wyman-Gordon's plant at North Carolina. Mrs. Wyman-Gordon says a 1000-ton press迫使 the forging press to drop the billet. Two of the forgings shown and three other forged shapes from one main billet. Wyman-Gordon says the forgings replace hundreds of components that are used as fibreglass bolted structures.

control centers with hardened launch sites near McConnell AFB, Mo.

Douglas Aircraft Co. and Rand Corp. have been awarded profit-sharing study contracts by NASA's Marshall Space Flight Center to determine post-Nova options chemical rocket vehicle configuration (AW Apr. 9 p. 17) for increased efficiency in boosting Navstar or gravity payloads.

Bell Helicopter Co. and Motor & Gear Ltd. of Texas, have signed a \$3-million licensing agreement covering de-

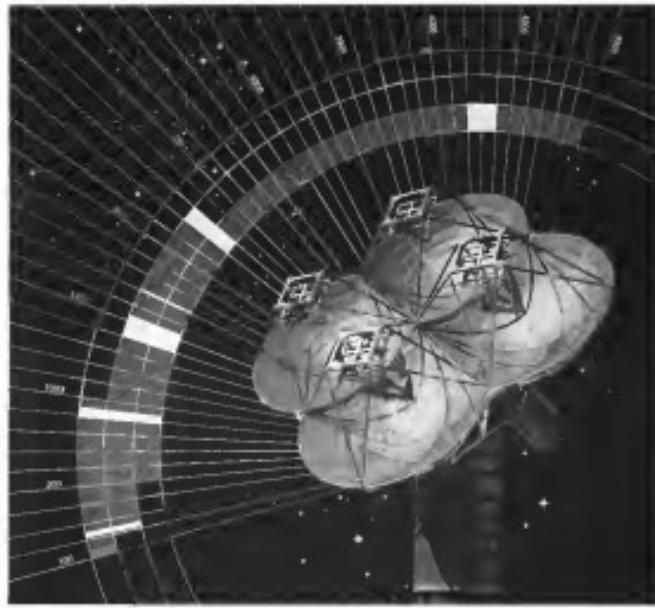
## WHO BUILT THE TIROS STRUCTURES?



RCA developed the NASA weather satellite... Levitt built the complex LR-100 side structure to carry its active components. Levitt specializes in the precision fabrication of sheet metal structures for missiles and space vehicles, aircraft and ground support equipment. Major contracts issued by NASA for Levitt include Levitt quality controlled services: Engineering, Production Planning / Sheet Metal Forming / Welding / Machining / Metal Finishing.



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## AT RADIATION, CHALLENGE IS OPPORTUNITY

*Example: A single system solves many wide-band-coverage antenna problems*

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Thus, TBS/COM minimizes the need for "satellite-foreign" or fixed changing associated with the myriad missions requiring orbit-to-ground support. A single set of RF terminals is used

for all functions. Maintenance is greatly reduced too, through highly reliable transmission servo circuitry, replaceable modules, immediate access to test points and adjustments of the front panels.

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Maurice H. Peleg



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stars and liberation of 16 of Bell's 104 Since nation joined together to the Japanese firm

Supersonic versions of the North American F-104 Starfighter. The new Bell liquid/hydrogen upper stage which will be launched initially is a new solid propellant booster approximately 87% more powerful than the booster for solid-state models of the target. The new booster will feature a longer nozzle, was fitted with Marquardt Solid Propellant Rocket Headstage, a carbon fiber internal liner, graphite skin fairing, motor for the separation section, the finned at SPD Mt. Gague, Tex., as an intermediate-size payload. The total payload 6000 lb. is about for about 6 sec. Bell's liquid/hydrogen flight propulsion is provided by a Marquardt rocket.

Arrow 124-E Ryan Biplane jet shown recently achieved a record altitude of 41,000 ft. and set a record endurance of high altitude by flying 34 min. at 31,000 ft. as shown in a flight over the White Sands, N.M., Missile Range. The flight lasted 112 min. of which 97 min. was powered flight and 15 min. was glide prior to parasite recovery.

Linde Co., division of Union Carbide Corp., has been selected by National Aeronautics and Space Administration to supply liquid hydrogen for NASA's second development stage of the West Coast space shuttle. Linde will construct the 575 surface cells for maximum procurement of about 275 million lb. of liquid hydrogen. Linde will build a liquid hydrogen supply plant near Sacramento, Calif., near the development site for Aerojet-General's M1 space booster. Linde is also supplying liquid hydrogen for West Coast sites from the company's new facility in Cheshire, Calif.

Bell Co. will build 28 bodies for airline passengers longrange aircraft in FAA Type Certification. Aeroflot, Moscow, D.C. will use a 51 1/2 ton aircraft manufactured from Chrysler Corp.

Navy rated agents VPAS and VP-44, based at Patuxent River Naval Air Station, Md. will be the first operating units to receive Lockheed P-3 Orion anti-submarine warfare airplanes. Test of 73 PUV-1 stand for squadrons due in the fall of this year will be delivered to Patuxent River in July.

Torrey Engineering, Inc., Encino, N.C., will build a ground station for the Triton program which will be made available for trials in all other North Atlantic Treaty Organization nations or Western Europe. The station will be 11 ft. wide  $\times$  12 ft. deep



OUCH.

Vibrations in the "High-Q" region have caused this astronaut to lose control of his space craft—an abort is certain. He will have a cup of coffee before his next flight. ■ Hazards of space flight are regularly duplicated in the moving-base maneuver aerospace flight simulator at the Wought Astronautics SPACE ON EARTH Center, — with realism right down to the bone-shaking vibrations which wring an involuntary "Ouch!" from test pilots. ■ The flexibility of the Wought simulator equipment permits it to mimic a wide variety of air and space craft with minimum modification, so that valuable information for America's space program is gathered without risk to human life or expensive equipment. ■ Beyond simulation, Wought Astronautics is at work on many space projects from orbital rendezvous to fuel tanks for Selenia and NASA's Scout rocket system. Write today for the complete story of the concept—countdown capabilities of the Wought Astronautics Division.

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## Sperry offers 60-day delivery on a low-cost K band reflex klystron

The SKR 291, a new low cost K band reflex klystron oscillating element, driver and cathode in microwave systems, is now available from Sperry Electronic Tube Division within 60 days from receipt of your order! Sperry's new tube operates at frequencies ranging from 26 to 28.5 GHz. Within these frequency limits, it offers a 17% air permeability band, a high voltage and a low temperature coefficient. The SKR 291 is priced at only \$165.

### PARAMETRIC PUMPING APPLICATIONS

The SKR 291 is specially suited to the requirements of parametric amplifier pumping units as power output — 10 mW maximum — is more than adequate for parametric amplifier pumping demands. Its low price, wide bandwidth, and inherent stability resolve the feedback and resonance limitations that have

formerly hindered the use of parametric amplifiers in many systems.

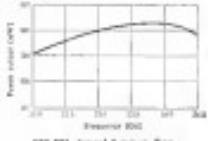
### OTHER APPLICATIONS

Sperry's reliable wave tubes also show great desirability for applications in short range communications systems, biomass, and microwave links. Extreme mechanical ruggedness, light weight (only 4.4 lb.), and small size, make the tubes ideal for airborne as well as ground based installations.

### NEW, FREE BROCHURE

A new, free brochure describes the capabilities of the SKR 291 in greater detail. For your copy, write to Sperry Electronic Tube Division, Sec. 146, Greenville, Florida.

Since the SKR 291 is available within 60 days, it represents an immediate solution to your present problems; whether you are designing a new system or continuing an improved performance for an operational one. Call 8 Co., which represents Sperry nationally, has sales engineers near you. We'll be happy to help you work out specific design details. Call 8 Co. today.



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CAIRNSVILLE, PA. / GREAT NECK, N.Y.  
SPERRY RAND CORPORATION

and will be designed to withstand an altitude 200 mi. above the earth with a -120° temperature.

England Industries, Inc., Newark, N.J., has received a \$1-million USAF contract to supply off-nominal predictable gravitation load pendulums of hydrogen to DDCI weather balloons.

Central Michigan Research Center has been established at Novi Beach, Conn., under the joint sponsorship of the Office of Naval Research and the Air Force Office of Scientific Research.

Improved Argon-wired stage selected entire program for Wing 2 Missiles over ICBMs scheduled for info deployment at Edwards AFB, Calif., will later become twice as light as those previous stage stages, and lighter weight than the second stage is scheduled to be, flight-tested at Cape Canaveral in November.

## MINIATURE ABSOLUTE PRESSURE TRANSDUCERS 15 to 10,000 PSIA

	Model 460	Model 50
Pressure Range	4.60 to 6.00 psia	0.00 to 0.0000 psia
Static Gauge Read	±0.4%	±0.2%
Operating Temp	-140° to +200°F	-40° to +120°F
Media Resistance	10 <sup>6</sup> ohm x 1.10 <sup>6</sup>	10 <sup>6</sup> ohm x 1.10 <sup>6</sup>
Weight	4 grams	4 grams

To 10-0 version, these two miniature linear transducers deliver a precision measurement as repeatable from 2.0 to 10.000 psia. Their performance and reliability are outstanding and typically exceed transducer life.

Sperry offers the broadest family of transducers in standard or custom designs. For more information, call 1-800-222-1234 or write to: Precision Pressure Transducers, Dept. 460, 1000 North Main Street, Bourns, Inc., Thousand Oaks, CA 91360. For additional sheet stock or more detailed specification information, when your requirements call for just plain measurement, specify Sperry Pressure Transducers. Write for brochures.

**15 years of proven reliability in missile and space programs**



### Crash Locator

Automobile lightweight tilt switch activated crash locator radio beacon is a replacement for the 1968 "Citation" GM hardwired and passive inertial measurement unit (IMU) that was developed by Bogen Electronics, Mt. Clemens, Calif. The device, called "Hercules," weighs 4.1 lb. and measures 4.1 in. long with a 1.5 in. radius. The beacon body has a sleek top surface. The bottom of the center and self contained module is 40 ft. 8 in. on the horizontal dotted lines. The manufacturer says Federal Aviation Agency research found a Federal Service Board approving the beacon. Unit will be sold by Mr. Cramus Division of GTE Corp., Bellwood, Ill.

### Get one now to clear it. Ultrasonically.

Complete ultrasonics is a major in the production of precision glassware parts. A grain of dust, a microscopic fiber, even a bacterium could spoil performance.

Managers of some of these tiny components and assemblies have found only ultrasonic cleaning can do the job properly... and high-powered Westinghouse ultrasonic equipment does the job best.

Solid state ultrasonic generators are trouble-free. All-metal Westinghouse transducers cannot be overdriven, and deliver noise blanking power per watt that may others.

Westinghouse offers ultrasonic equipment in tank sizes from 1½ to 800 gallons and powers up to 1000 watts, or cleaning installations designed to your individual processing needs.

For further information or a demonstration contact Westinghouse Industrial Electronics Division, 2015 Wilkins Avenue, Pittsburgh 3, Md. You can buy it at Westinghouse.

Westinghouse  Ultrasonics

General Electric High Reliability solid or

foil Tantalytic\* capacitors qualified for:

ATLAS-MERCURY  
MINUTEMAN  
NIMBUS  
OAO  
TITAN  
POLARIS  
DYNA-SOAR

# NEXT?

Your program can be the next to benefit from the unprecedented dependability of General Electric High Reliability solid and foil Tantalytic capacitors—products of a major breakthrough in capacitor reliability. What made the High Reliability line possible? A completely separate management group, a separate white room facility, and constant testing of capacitor designs (250,000 unit test hours weekly); then, in-process computer control of unit manufacture to assure adherence to test results. Now, our unit failure rate goal of .001% per thousand hours on foil has been achieved. Foil ratings available from 10V (.25μF) through 150V (300μF), 85C or 125C; solid ratings from 6V (.033μF) through 35V (130μF), all 85C. Join the seven programs which have already qualified these capacitors. Build General Electric High Reliability capacitor dependability into your present or future programs. See your G-E Sales Engineer, or write Section 430-08, General Electric Co., Schenectady 5, N.Y., Capacitor Department, Irene, South Carolina.

Reg. U.S. Patent & Trademark Office

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**GENERAL**  **ELECTRIC**



# Practical temperature measurement from 1°K to 7000°F

7000°F

4144°F	ROCKET PROPULSION COMBUSTION RANGE (Infrared Radiometers Pyrometers)
5000°F	

**Honeywell supplies workable, accurate cryogenic thermometers, resistance thermometers, thermocouples, and infrared Radiometers for measuring temperatures from the very bottom of the temperature scale to well beyond the combustion range of most rocket propellants and propellant combinations.**

3032°F	INDUSTRIAL PROCESS RANGE (Infrared Radiometers Pyrometers, Thermocouples)
300°F	

**FOR THE NEW WORLD OF CRYOGENICS.** Today, aerospace rocketry, electronics, and new industrial processes depend on more and more on liquid cryogenics. The workshop and laboratory of extremely low temperatures in materials testing and metal treatments, superconductivity, nuclear, and many other applications open up a world of possibilities. As constantly improved and more effective cryogenic tankers, pumps, insulation, vacuum development, the useful application of cryogenics has now opened up new supplying instruments for measuring and controlling extremely low temperatures. Typical of this is the creation of the Honeywell Germanium Resistance Thermometers which measure from 1°K to 100°F. Available in probe, surface contact, and threaded insertion models, it provides a relatively strong signal output that can be easily measured and scaled by means of standard potentiometers such as Honeywell's Biostream® 38.

133°F	BIOLOGICAL RANGE (Wire-bulb dental therm. thermometers, thermocouples)
77°F	

**TO 7000°F.** Beyond the Industrial Process Range lies another which may conveniently be called the Rocket Propulsion Range. In these temperatures, up to 7000°F (4144°K), most rocket propellants and combinations of propellants have operating temperatures below the figure. Within the upper limit of Honeywell's small range, infrared Radiometric Pyrometers.

-280°F	ENVIRONMENTAL RANGE (Infrared systems; resistive resistance thermometers; Type T thermocouple)
-190°F	

**GREETING WARMER,** the Environmental Range (-280°F to 0°F) is reached. Here extreme cold, such as that experienced in space simulation, must be accurately measured. Beyond the Industrial Range, a narrow band of temperatures, roughly from 0°F to 300°F within which ordinary life functions are possible. Far back of these ranges,

Honeywell supplies filled bulb thermal systems, resistance thermometers and thermocouples for very close measurement of temperatures under widely varying conditions.

**GOING UP THE SCALE.** In the practical use and measurement of heat, the Industrial Process Range is reached. This extends roughly from 300°F to 500°F. Honeywell makes a number of standard sensors for use in this particular range: infrared Radiometric Pyrometers and many types of thermocouples, each of which has its own individual measurement range and sphere of usefulness.

**TO 7000°F.** Beyond the Industrial Process Range lies another which may conveniently be called the Rocket Propulsion Range. In these temperatures, up to 7000°F (4144°K). Most rocket propellants and combinations of propellants have operating temperatures below the figure, within the upper limit of Honeywell's small range, infrared Radiometric Pyrometers.

If you are involved in the measurement of high, low, or intermediate temperatures, Honeywell can undoubtedly be of real help to you. In addition to having the world's most complete line of instruments to work from, Honeywell assumes the complete responsibility for entire instrumentation and control systems, from feasibility studies through final engineering, commissioning and maintenance. If you are doing work that involves temperature extremes, call your nearest Honeywell Branch Office: Minneapolis-Honeywell, 3940 University Avenue, Philadelphia 44, Pa.; or Canada, Honeywell Controls, Ltd., Toronto 14, Ontario.



## Dassault Balzac Engine Details Shown

French Dassault Avro VTHL fighter (AVM 305 30 p. 15) will use eight Rolls-Royce RR 109 jet engines mounted in the fuselage during its flight trials. The aircraft is shown in flight in the background. Engines at right is Rolls-Royce RR 102 used in Dassault Mirage IV, planned to follow on. Below, Balzac inverted bleed air outlet for fighter shown as pressure jet off of the engine cases just prior to takeoff. Bleed valve closed due to 4th engine case vitals about 15 in. and lower case lowered down owing to cold rate. At speed increase, spring-loaded levers are closed, and following rotation shot at closed. Both



## Honeywell

This is Control



#### 4 GOOD REASONS TO SPECIFY PACKARD FEP TEFLON<sup>®</sup>-INSULATED CABLE

**BUILT-IN UNIFORMITY** FEP Teflon-insulated cable can be extruded in continuous lengths (measuring thousands of feet) without joints. The high temperature insulation is uniformly dense the entire length of the cable.

**40°F TD - 400°F ENVIRONMENTAL RANGE** Its current temperature range makes Packard FEP-insulated cable especially suited for aircraft, missiles, electronics and spacecraft. Its resistance to efflorescence at prolonged operating temperatures up to 400°F. Yet it flexes without cracking or crazing at -40°F.

**HIGH DIELECTRIC STRENGTH** The high dielectric strength of FEP insulation makes it possible to produce cables with unusually small diameters. And it's not affected by any of the fuels, chemicals or solvents used in aerospace applications. FEP insulation gives this same protection when it's used as a jacket over shielded or multiple conductor cables.

**MEETS MILITARY SPEC'S** Packard FEP-insulated cable is made to meet the requirements of the latest revised military specification MIL-W-16878. And it's available in colors or with color-coded tracer.

\*DuPont Trademark

For complete information on Packard's wide line of aerospace cables, contact the Packard Sales Office in Waukegan, Illinoi, or either of the branch offices—Detroit or Los Angeles.

**Packard Electric**



"Last Wire" Division of General Motors

## FINANCIAL

### NAA, Douglas Report Increase in Earnings

North American Aviation Inc. and Douglas Aircraft Co. have shown significant gains in 1967 earnings since a considerably period earlier, according to financial reports released recently.

North American earned over \$240 million on a gross income of \$1145 billion for the nine-month period ended June 30. Earnings for the same period last year were \$205.5 million on a gross income of \$831.1 million.

Non-month NAA earnings for year were equal to \$2.94 per share. In 1966, shares outstanding comprised with \$2.36 per share for \$2.2 million shares in 1965.

Douglas reported third quarter fiscal year earnings of nearly \$5 million in sales and other income of \$421.1 and losses of about \$8.00 cents per share on 10.5 million outstanding common shares. The company had its stock trading at June 30 stood at \$1129 billion compared with \$916.4 million for the long list test.

Douglas Aircraft reported a \$2.5 million net profit equal to 44 cents per share on sales of \$104.9 million for the second quarter of its fiscal year ended May 31. Second quarter figures for 1967 showed \$1.7 million earned on sales of \$227 million, equal to 38 cents per share.

Douglas' total earnings for the first six months of fiscal 1967 were over \$1.1 million, or about \$1.10 per share. Sales during the period were \$109 million. Consolidated figures for all three periods last year showed \$1.7 million earned on sales of \$431.9 million, equal to 32 cents per share.

### Financial Briefs

National Aerospace Corp. and sub-subsidiary reported net earnings of \$436.7 million for the six-month period ending March 31, 1967, increase over net earnings of \$266.994 for the same period last year. Consolidated net sales for the period totalled \$3.5 million, the year compared with \$4.3 million for the same period last year.

Local Electronic Corp. reported a net income of \$1.7 million on sales of \$41 million, the total was up 10% for March 31. The figure compares with earnings of \$1.5 million on sales of \$35.7 million for the fiscal year ended Mar. 31, 1966.

Riley Corp. had net earnings of \$1.8 million on sales of \$128.7 million for the

services for aerospace contractors:



## ENVIRONMENTAL EVALUATION

Arma environmental laboratories are among the first in the nation, originally designed for stringent testing of the all-inertial guidance equipment now in operational service on Air Force ATLAS missiles. These facilities, including the world's most positive large cartridge test orbit, can now provide complete engineering evaluation services for contractors. Outstanding simulation equipment plus a competent staff of experienced engineers is available to help design and develop better, more reliable equipment and components through environmental testing.

## STANDARDS AND MEASUREMENTS

Comparable in many respects to National Bureau of Standards facilities, the Arma standards & measurement laboratory is available to outside contractors for assistance on specialized measurement problems and quality control activities. Certificates of reference and working standards and calibration of records can be provided. Facilities for electrical measurements in the radio spectrum are the most available.

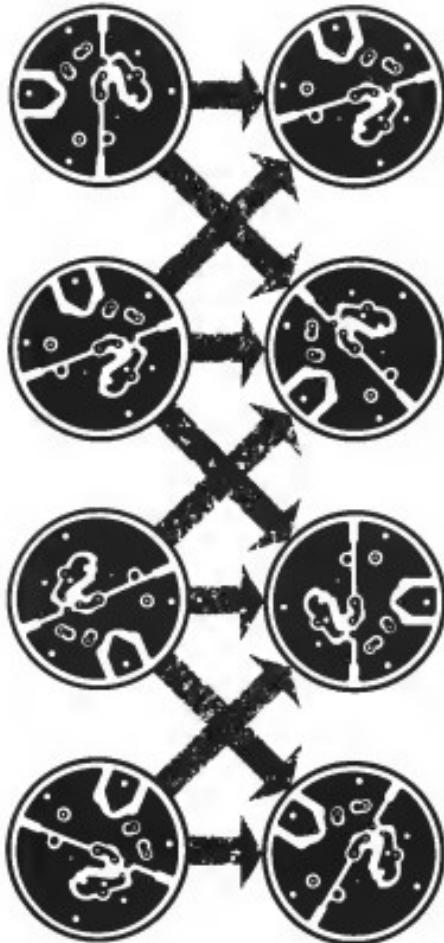
These Arma laboratories were used in the development and production of the Atlas all-inertial guidance system and the B-52 fire control system. These sophisticated projects fully demonstrate Arma's qualifications to offer expert assistance to those seeking the finest in facilities, personnel, and experience.

Complete technical information on the services available is contained in a 24-page brochure ENAT-1. Write Corporate Government Marketing, Arma Division, American Bosch Arma Corporation, Garden City, N.Y.

**ARMA DIVISION**

**AMERICAN BOCH ARMA CORPORATION**





**IN INFRARED LOGIC SYSTEM,** the first in-line IRI advantage of the new high-speed computers of the nosecone, optically separates 30 items faster than unaided, chaotic.



NEWS OF DEFENSE TECHNOLOGIES

## DATA

To perform effectively, modern defense systems must continuously evaluate every dynamic situation within their environments. Data must be speedily collected, rapidly compared with valuable base memories, and be presented in an organized, accurate and brief display — is real time. All this is sound human judgment, that unmatched prime factor of military strategy.

General Electric has played a major role in advancing the technologies of data utilization and display. It's beyond them truly form where visual computations of range and track data were accomplished at the pilot board. For example, General Electric introduced the AN/GP-17 Radar Course Director, the first mass-produced equipment to perform automatic tracking and automatic computation of the intercept problem. Later developments included the AN/FPS-37 Detector Training Group—the first equipment to demonstrate automatic detection and tracking of radar targets in all three dimensions—and the new Air Weapons Control System 432L, which provides the U.S. Air Force with the most modern aerospace management available.

Today's accelerating progress in data technologies is evolving from leap-frog advances in logic and memory circuits and display techniques, and from an expanding scope of responsibility for the data processing and display functions. General Electric continues to make significant contributions to these technologies.



**CYBERNETIC ASSOCIATIVE MEMORY** enables computers to function like a human brain by instantly, easily comparing and examining a new fact with old stored in its memory.



**THREE-DIMENSIONAL DISPLAY** provides a series presentation of all spatial activity within an object's range, in true perspective with code references. In all three dimensions.



**COMPACT ANALOG DISPLAY** for flight-lying or flight-control applications compares to "point" motion-TV picture the ground reference in the stepped-out foreground.



**350-60 RADAR SYSTEM** locates up to 65,000 stations and scanned in real time, with a resolution rate of 100,000 pulses per second, using digital processing equipment with extremely sensitive components.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

DEFENSE ELECTRONICS DIVISION





**HAMILTON STANDARD** adds the Maritime Administration's first hydrofoil vessel with surface stability fully designed for speeds up to 30 mph, was produced for Grumman Aircraft Engineering Corp.



**HAMILTON STANDARD AAE** for Navy's HSS-2 AWB helicopter stabilizes the aircraft in roll, pitch, and yaw. The system also provides complete attitude control for any preset flight mode, plus roll-moment stabilization for all flight regimes.

## Automatic stabilization for any vehicle, air . . . land . . .



**HAMILTON STANDARD AAE FOR U.S. NAVY** Hydrofoil-driven will stabilize the vessel at high speed. System will hold roll at required height above water, constant rate, with pre-set limit side slopes toward banked turns in maneuvering seas. (Courtesy Lockheed Corp.)

Automatic stabilization equipment, now being built by Hamilton Standard for the Boeing Company, will control and stabilize the Navy's first hydrofoil patrol boat—a 115-foot craft. The new system is similar to AAE which Hamilton Standard produced for an 80-ton hydrofoil vessel being built by Grumman for the Maritime Administration.

**HEART OF THE SYSTEM** is a compact, four-channel, automatic computer which maintains

a command setting of the inertial pilot, and corrects for variations or changes in roll, pitch, and yaw. Both Hamilton Standard systems are exceptionally rugged, oil-tightized, capable of operating in solvents from -60° to +180° F. **AAE FOR HELICOPTERS** furnished the technological foundation for this advanced hydrofoil control equipment. The flight control unit for the Sikorsky HSS-2 AWB helicopter was designed and built by Hamilton Standard. It

was the first to combine autopilot and autopilot coupler in one package. Such systems, readily adaptable to all types of aircraft, provide extreme compactness and high reliability.

**AAE FOR GROUND VEHICLES**—both military and commercial—is rapidly becoming an important design consideration. Hamilton Standard control systems, for example, could greatly improve the mobility and effectiveness of tanks, missile launchers, weapons carriers,

tractors, cranes, bulldozers, and shovels. **AUTOMATIC STABILIZATION EQUIPMENT** for hydrofoils, aircraft, and other vehicles is part of a comprehensive program at Hamilton Standard today. For complete information about these systems—and other advanced control devices for missiles or space vehicles—phone or write Hamilton Standard Electronics Department, Broad Brook, Connecticut.

**Hamilton Standard**

**U**  
**A**

DIVISION OF UNITED AIRCRAFT CORPORATION

# WORLD'S MOST PERFECT GYRO?



Because of the virtually frictionless environment of its rotating element, the Honeywell ESG (Electrically Suspended Gyro) offers very low drift rate, long life and high reliability. Eliminating conventional mechanical suspension, it operates in a coasting condition for long periods of time with optical pickoffs sensing its orientation. Like the stars, this gyro will serve as a precise reference for long range navigation.

The Honeywell ESG was originally developed with funding by the Navy Special Projects Office and Wright Air Development Division. Further developments, including the MEG (Microstatis Electrostatic Gyro), are being made with the technical support and funding of the USAF Aeronautical Systems Division, as well as company sponsorship. The MEG demonstrates Honeywell's advanced technology in the field of inertial systems and sensors.

The ESG and MEG are based upon Honeywell's experience in developing and producing more than 35,000 inertial gyro's and accelerometers. These inertial devices have been used on 62 of America's successful orbital shots and on such missile programs as Sergeant and Polaris.

For further information on Honeywell's inertial sensor capabilities, from research through manufacturing, write Dept. AHW-58, Minneapolis-Honeywell, Minneapolis 40, Minnesota.

**Honeywell**  
H Military Products Group

**H** Military Products Group

shares of common stock at \$1. Price decline  
of the board 100% to value 10-100  
shares of common stock at \$1. Holdings  
decreased 100% preferred method value  
plus shares of common stock at \$1. Total  
plus common stock position 100-100

**B** • *Brachyrhynchus* 1000 species and many  
more in the process of being described  
and many more known than in *Encyrtidae* or  
**C** • *Encyrtidae* 2000 species of which about

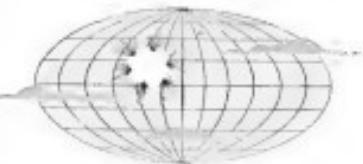
For a detailed discussion of E. B. Tamm's theory see 1949

last year 100 shares of members stock  
B. Chapman 40 older for 100 shares of  
stock & stock B. W. Steele 100  
shares of stock 400.8 B. M. Schell 41  
shares of stock or equivalent 100.8  
shares of stock amount as of Dec. 31

**Federal Budget** President Nixon's proposed \$163.6 billion revenue total is \$110.2 billion above the 1968 total.

192 107-50 subsp. *F. Nodosa* (the greatest  
number) - 100% share of common  
steak. In W. Spain they recorded 115-  
120% shares of common steak which  
is more diverse (44% share of common  
steak). In E. Italy, they record 100% share  
of common steak. In S. Italy, 100% share  
of common steak. In Q. Flanders,  
they also share of common steak. In W.  
Wales, 100% share of common  
steak. In E. Ireland (1970) 100% share of  
common steak. In G. Wales (1970)  
share of common steak. All steak house

## LIMITED WARFARE



A CONTINUING SEARCH FOR  
NEW KNOWLEDGE AT  
CORNELL AERONAUTICAL  
LABORATORY

Within recent years an increasing group of substantiation various have been raised in a plan for enhanced stability no strong one limited was rapidly. Now imagined is that aspect of our paradigmatics at a certain need of technological substantiation, the demand is being for new concepts in the areas of quick distinction, wide dispersion of small portions, highly creative use of cascading, great mobility of groups and forces, and the ability to capsule on the times affected by night and weather. Today, at least 15 years prior, an important register of CALS research effort is devoted in such goals.

Current studies include revised weapon systems design information and control systems, reagent synthesis, and surveillance, random force mobility, CBR warfare, countermeasures, penetration role, and new weapons concept. CAC's working look at the developments of the future includes more than a dozen research and development projects aimed at solving problems of limited warfare. They are problems that offer enormous opportunities for engineers and scientists. If you are interested in becoming a scientist at one of our research, clearly knit research units working on far-reaching scientific and technological programs, we are ready for a first copy of our factual, illustrated employment prospectus entitled "A Community of Science."

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of Cornell University  
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## THE LINE OF LEAST APPLIED COST...

### Multiple Coaxial Cable Connectors by AMP

AMP produces a full line of multiple COAXICOM® connectors with standard, miniature and subminiature contacts accommodatting a range of RG11 cables with nominal overall diameter of .035" to .250". They all have one feature in common: All the contacts in each connector are crimped. Take away soldered bands, solder pot and solder iron—there's your first saving! And that's only the start. The matching AMP crimping tool that terminates the contacts makes reliable connections of both the inner conductor and outer braid with one easy stroke of its "Cinch Crimp™" ratchet controlled handles. Once and done! No production slow-ups as with combination solder and crimp terminations or multi-step crimping procedures. AMP COAXICOM connectors and contacts save time, and that's your second saving. Reliability? Over the years, AMP has developed over 15,000 different electrical/electronic terminals, products and materials for their application. Write and learn how they've done this same, reliable, fast coaxial connections. Get the full story on AMP COAXICOM multiple connectors today.

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Harrisburg, Pennsylvania

1970 edition of *multiple* brochure on multiple  
coaxial connectors from AMP.  
Circle 100 on Reader Service Card



\*Courtesy of AMP Incorporated

## AVIONICS



THREE DIMENSIONAL FLIGHT INSTRUMENT (above) and dual seat required command authority (right) those handled on Beech D-18 are new low-approach instruments developed by Cullen Radio Co. The T-3 flight instrument system meets all information needed in pilot flying instrument approach in a single presentation, but uses three dimensional, fixed mount and V-shaped bars for command steering inputs to avoid cluttered, difficult-to-read displays. Units are now undergoing flight evaluation.



### Depth Adds Realism to ILS Indicator

By Philip J. Klass

Cullen Radio Inc.'s new flight instrument which deploys much of the information used in an instrument approach to an instrument approach, using a three-dimensional presentation to create realism and close-in confusion has been developed here by Cullen Radio Co.

Another new instrument is a peripheral command indicator (PCI) which projects both pitch and roll information in a single plane, centered on the heading, glideslope and localizer. The Cullen PCI, developed in the United States (patented in the United States) presents directions in the display directly in the pilot's field of view.

Both of the instruments were developed by Cullen as part of a company program to improve and test latest electronic instruments (AVC Jan. 1 p. 65). Engineering work installed in Beech D-18 has demonstrated in several aircraft, beginning prototypes will be available as equipment. Cullen is in the middle of development for instrumentation and controls.

Thus far, two main attempts at the problem have been made to combat the information deluge. One is to condense the information displayed on several instruments into a single flight indicator. But the result usually looks like a confused jumble of data from three different sources without cluttering the display.

The new 3-D indicator displays for the pilot:

- Pitch and bank steering commands from the flight director computer for instrument approach or some flight and also for monitoring present flight altitude.

- Azimuth displacement with respect to ILS or VOR bearing. Then information would come in as separate components indicated.

- Bank indicator, using a half-type indicator.

- Vertical displacement, showing aircraft altitude gained or lost in feet. In a solo radio receiver, other messages.

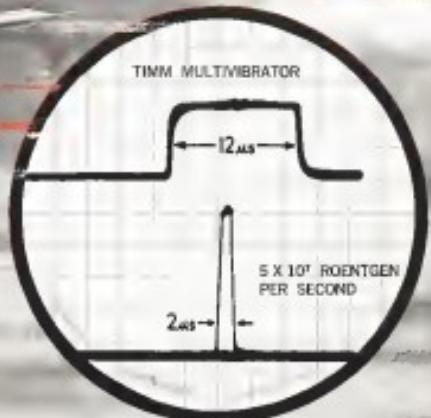
- Approach speed, with respect to a pre-selected approach speed speed.

The central element of the new instrument is a three-dimensional, color-coded, slanted, semi-circular symbol which rotates fixed in the center. The symbol symbol is positioned to simulate the pilot's view of the zone of his control.

Immediately behind the symbol will be the pitch and bank indicators with a blue surface above the horizon line while the portion below is black with white dots and lines to give perspective. (See Fig. 1, p. 65.)

With the symbol about six degrees off the horizon, display background moves down as up with respect to the aircraft symbol. An azimuth bar spans a circumscribing tilt of the slanted display.

**NOW**  
 electronic systems  
 can be "hardened" against  
 nuclear radiation   
 with  
**TIMM**  
 circuits



TIMM OPERATION DURING  
 $5 \times 10^7$  R/SEC RADIATION PULSE

High-intensity radiation pulses from a nuclear explosion can produce disrupting electrical transients in electronic circuits. With conventional circuitry, transient radiation can amperize memory circuits... permanently trigger a decision circuit... or block radio transmission. It may cause equipment to malfunction at distances once considered safe from nuclear heat and blast.

To illustrate: A "small," one-megaton explosion in space may produce a crippling  $10^8$  R/sec. pulse more than 200 miles away.

**TIMM Circuits** will operate 90 miles closer to the blast, using the one-megaton example... and no shielding is required. Examine your system requirements in light of these exclusive TIMM features:

- **Higher Radiation Tolerance (Transient and Steady-state).** TIMM circuits have an indicated capability of  $10^9$  R/sec. pulse-radiation tolerance and  $10^8$  net fast neutron tolerance, without shielding. These are, respectively, 3000 and 10,000 times greater than the radiation tolerance of other man-made approaches.

- **Higher Temperature Tolerance.** TIMM circuits have an indicated long-term operation at 500°C. No cooling equipment is required.

- **Wide Frequency Capability.** Fast switching action and high reliability are assured.

- **Less Regulated Power Required.** Bulk-in bias and high-temperature operation reduce outside power requirements. Efficiency goes up as packaging density increases. Voltage regulators are eliminated.

- **Practical Miniaturization.** System size is determined by circuitry rather than by cooling or shielding requirements. Operating-component densities to 1,000,000 R/cm<sup>2</sup>.

- **Rugged Construction.** High shock and vibration tolerance.

**TIMM Circuit Elements Now Available.** Individual elements (transistor, diode, and triode) are now available for broad-based experimentation.

A personalized presentation of the complete TIMM story can be arranged at your convenience and location. For more information, or TIMM literature, write to: General Electric Company, Receiving Tube Department, Room 2235, Owenboro, Kentucky.

*Progress Is Our Most Important Product*

**GENERAL**  **ELECTRIC**

Information from countless sources, supporting amounts of it. New information that changes from moment to moment, old information that must be reviewed from storage in encode information of world importance. This is what command decisions are based on. This is what a new science-technology must cope with to help make command decisions possible. The science-technology of which we speak involves the development of man-machine systems to provide information processing assistance for military and

government leaders. The scientific field has created a number of new positions at Systems Development Corporation. Our scientists, engineers and computer programmers applied this science-technology to help develop SAGE. We now apply it to our work on the SAC Control System and other command and control systems being developed. At SDC, our staff participates in key phases of system development, analysis, synthesis, computer simulation, system learning and evaluation. Human Factors Scientists, Operations Research Scientists,

Engineers and Computer Programmers interested in joining this rewarding new field are invited to write Dr. W. E. Bell, SDC, 4411 Colleyton Ave., Santa Monica, Calif. Positions are open at SDC facilities in Santa Monica, Los Angeles, D.C., Oregon, Mass., and Peaseau, N.J. An equal opportunity employer.



**System Development Corporation**  
Systems that help men make decisions and  
exercise control



Decision-making  
in the Sixties

general to the left or right. As seen at the top of the horizon display, along with a scale provided directly above it, gives the pilot a sense of remaining lateral bank angle. At the bottom of the instrument is a half-type inclinometer similar to one used in a hand-held turn indicator.

#### Steering Commands

Controlled steering commands of the flight director type, telling the pilot to fly up down left or right, are displayed at the front of a three-dimensional "instrument" which actually rotates the aircraft in its seat. The so-called "V" shape is formed by two passive velocity solenoids in the pitch steering model, which move in unison.

The "V" has static with respect to the aircraft world longitudinal tendencies to roll for a load, yawwise and rise or fall vertically to roll for a climb or dive. The pitch command has an effort to move the cockpit roll onto the "V" as shown in a steering section. Called "flight level indicators."

Although it is not readily apparent in two-dimensional photos of the entire instrument, the "V" has created the illusion of a track in the sky in which the pilot's aircraft would continue the motion line of the instrument.

During an automatic approach, the "V" has reported both the BLS level and glide slope as an approach mode, showing this display steering commands rather than actual aircraft position relative to the center of the "V," the horizon. During an auto flight the "V" has reported the steering commands to center on the VDR, airway and to maintain predetermined altitude.

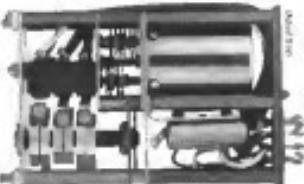
During an instrument approach wrong



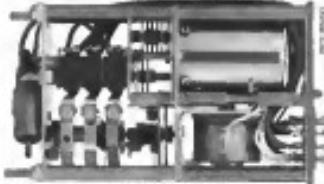
Thermal Ceramic

Thermoelectrically driven, soft switch more better than switch had. Has extremely high melting point of 2,800°C and is an excellent thermal switch at temperatures above 1,200°C according to Minneapolis Thermocell, which developed the miniature solid-state device. New ceramic has resistance strength of about 25,000 ohm-parts of 99.9% and a power of less than 27.5 milliwatts/hour/cm<sup>2</sup>.

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Data: 10 bits Data body: 10 bits  
IFP-100 Multichannel Suppression Transponder  
Range: 100 miles Data rate: 10 bits/sec.  
Data: 10 bits Data body: 10 bits  
IFP-100B IF Suppression Transponder  
Range: 100 miles Data rate: 10 bits/sec.  
Data: 10 bits Data body: 10 bits  
IFP-100C IF Suppression Transponder  
Range: 100 miles Data rate: 10 bits/sec.  
Data: 10 bits Data body: 10 bits  
PDR-100 Solid State Data Receiver  
Range: 10 miles Data rate: 10 bits/sec.  
PDR-100 Solid State Data Transmitter  
Range: 10 miles Data rate: 10 bits/sec.  
PDR-100 Solid State External Receiver  
Range: 10 miles Data rate: 10 bits/sec.  
PDR-100 Solid State External Transmitter  
Range: 10 miles Data rate: 10 bits/sec.  
PDR-100 Solid State Command Receiver  
Range: 10 miles Data rate: 10 bits/sec.

flight director-computer steering commands, the plot periodically marks the orientation of using his actual aircraft position relative to the horizon and glide slope, to monitor the proper operation of the flight director.

This information also is displayed on the new Cofair instrument. The earth position relative to the glide slope horizon center is shown as the position of a diamond-shaped moving pointer along the left edge of the uncorrected world position with respect to the location of earth center shown along the bottom by means of a parallelogram indicating moving with respect to a horizontal scale. (See Fig. 8 in 183.)

A vertical scale along the right edge of the instrument, with a warning flag-shaped pointer is used to display world position relative to a planned value which is optimum for the aircraft and its particular landing.

#### Terrain Clearance

Not shown in the accompanying photographs is the terrain-clearance indicator, which would be activated by signals from a radio高度表 altimeter. This will take the form of a "T"-shaped symbol which begins to appear just behind the parallel track indicator reference when the aircraft altitude approaches 200-300 ft.

As the aircraft continues to descend the "T"-shaped indicator will move up toward the fixed aircraft symbol, with the top section of the "T" representing the terrain. This gives the illusion of the aircraft symbol descending to the terrain as the aircraft comes coming up to meet the aircraft.

When the instrument is being used for an auto landing, the glide slope and terrain indication along each edge are



#### IF Amplifier

This is the IF amplifier, with 60 dB gain per stage, from 100 kc to 10 MHz. The temperature range of -55° to +100°C. The amplifier measures 1 x 1 in. and its weight is less than 11 grams. The amplifier was developed in General Electric Co.'s Light Metal Electronics Dept.

## Four important questions you should ask before selecting any scientific or engineering computer.

They lead to the one sure way to find the computer that suits you best.

A computer investment can be a wise one or an expensive one. Basically it depends on finding the computer that best serves your needs. The Recomp line of solid state scientific and engineering computers has been built ideal for many leading companies. If possible, it could best meet your needs. The following questions may offer some assistance in your choice:

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A feasibility study showed that a Recomp computer could save almost \$30,000 more than the next best computer in a year-long project. In addition, Recomp offers an ideal lease price range. For medium-size needs, Recomp's \$2,495.00 and with a complete line of peripheral equipment goes to \$4,495.00. Recomp is ideal for small-scale needs. You can lease one for \$1,495., complete.

#### (2) What software is available?

Comprehensive software—complete compilers, interpretive routines, programming libraries and extensive scientific applications, matrix prints, etc.—will help you get the maximum use of your computer. Recomp's software and documentation is second to none in quality and quantity. And an extensive programming library is available without charge.

#### (3) Who will you have to hire specialized computer personnel?

Some companies demand specialized programming personnel to operate them. Others are so simple that engineers can program their problems directly. The ease of programming saves time and increases computer use. One of the newer computers to program and operate is Recomp. Engineers with less than eight hours instruction are able to use the computer profitably.

#### (4) What will a computer do for you?

Some companies demand complex programs to do this and you have one in your own line. Most companies find imports of axes in relation to the one they originally bought the computer for. But some engineers are more helpful than others. For example, a company that once put 2 proposals a year from a top creative architect was able to increase this figure to 30% with a computer. Another company that was stamping this company as now able to get one proposal each year.

#### The four easy ways to select a computer:

The computer requirements of every company are unique. The best way to find the computer that best suits your specialized requirements is through a computer feasibility study. This is the only way to know exactly what your needs truly are and prevent unnecessary costs.

Or, if you already have a computer, a feasibility study is complete without Recomp. Put Recomp's software with your competitive computer on the market. Let the facts speak for themselves. Write today for this helpful guide, "How To Conduct A Computer Feasibility Study."

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**ANTI-SUBMARINE WARFARE**, Ryan pioneered the application of Doppler to Anti-Submarine Warfare systems and is a principal supplier of this equipment for both rotary and fixed wing aircraft in the United States and abroad.

**"ON THE BEACH"** Navigation at seaplane speeds can now be successfully achieved with the new Ryan IV Navigation System with capabilities ranging from zero speed to 2000 feet at altitudes from take off to 20,000 feet.

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Over strange jungles, deserts, mountains, seas—the most practical answer to aerial navigation yet devised is the new Ryan IV Doppler Navigator developed by Ryan Electronics.

Without outside navigational aids, the self-contained, accurate and reliable Ryan IV invites positive precise all weather navigation in Army, Marine and Navy (anti-submarine warfare) helicopters. This system also has universal application to a broad spectrum of fixed wing aircraft, ranging from V/STOL to supersonic types.

World leader for 15 years in the design, development, and large-scale production of Doppler navigators, versatile, fast moving Ryan is also making significant contributions in other space age areas.

For example, Ryan is building the newest concepts in vertical take-off aircraft. And today, as for years past, Ryan is the major supplier of advanced jet target drones for all the Armed Services. Among other Ryan activities are Flex Wing applications, electronic systems for lunar landings, and structures for space vehicles.

Your inquiry is invited concerning these and other capabilities of Ryan Electronics and Ryan Aerospace in the design, development and fabrication of space age products.

RYAN AERONAUTICAL COMPANY, SAN DIEGO, CALIFORNIA

**RYAN**  
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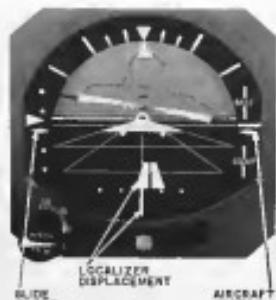
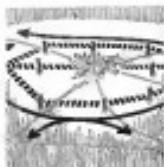


FIG. A

**MULTITUDE OF FUNCTIONS** displayed on new Collins flight instruments in face-displacement are shown in the broad-sensational mock-up which looks nothing of actual instrument. Fig. A shows fixed aircraft symbol behind which the colored horizon background moves up, down, or rolls left or right. V-bars have same module to indicate steering commands. Fig. B shows how aircraft position relative to ILS beam is reflected by moving diamond (left object) and parallel track (below). Aircraft speed with respect to pilot selected value is shown along right edge of instrument. Net shows a V-shaped indicator which moves up toward bottom of aircraft symbol to show ground speed; speeded-up time signals obtained from radio or radar sources.

aeronautically oriented by small shutters to cover the display area.

Collins has conducted extensive tests since last fall with the first of the new 3-D instruments and is preferring a 3-axis system which permits continuous and simultaneous adjustment of instrument approach precision to evaluate the configuration. Future test flights will demonstrate the system's adaptability to potential customers and soft support flight tests on the company's Convair.

The engineering model installed in the DC-13 is being used for presentation, but Collins may design a "box version" for orbit or other maximum reliability for a longer duration.

The engineers believe that the three-dimensional V-displays are more natural and convenient for the pilot to make pitch and bank maneuvering judgments. Their displays utilize two separate needles to show pitch and bank steering cues with increasing power to correct first one axis, then the other. Price says the coordinated maneuver is preferable, particularly during final phases of the approach when time is running short.

The principal visual type infections passed to the State of England, in particular, include for displaying multi-directional audio during the final approach while the pilot is looking out to establish visual contact with the target aircraft.

The British device consists of a multi-directional receiver with twelve pole

audios whose rotation in either direction can be seen and sensed using polarized vision. One such indicator can easily be mounted directly under the cockpit to display pitch and steering commands while another is mounted in the side in front of the helicopter corresponding to aircraft station in board.

In the new Collins peripheral control indicator (PCI), there are two concentric cylinders, each driven by a magnetic motor, with the outer cylinder made of a transparent material. Both cylinders have helical markings, but are wound in opposite directions (see photo at 49).

By an interaction of the two helices, pitch and roll inputs to the pilot to be a series of white diagonal stripes against a black background. By applying suitable signals to one or both motors, these white diagonal stripes can be made to move left or right up or down in a 3-D signal direction when both pitch and bank corrections are applied.

To stop the motion of the cylinders, the pilot moves his control column in the same direction with the magnitude of return deflection being proportional to the speed with which the elements appear to move.

Flight tests show that the slighter amount of motion which develops suddenly across the pilot's attention even though he may be concentrating his view outside to make visual contact. Price says the tests indicate that pilot

reaction is rapid and predictable and that the display technique is a single indicator encourages the pilot to make both pitch and bank changes in a single coordinated manner.

In the production design, the width of the peripheral control indicators will be increased with a shorter distance distracting the pilot until the aircraft is in final phase of its approach.



Log-Periodic Antenna

Log-periodic antenna has operation in frequency range of 220 to 4,000 mc., a bandwidth of 18 db, and a directivity approximately 15 db. Antenna can be supplied with polarized feed, remote tuning unit with remote control of polarization. Power loss during assembly is 4.5 watts. Manufacture is Done & Murphy Inc., 1910 Concourse Ave., Chatsworth, Calif.

## Look to the Bell System for integrated, broad-scale communications systems ...whatever the military need

On this page are just seven of the many types of communications systems worked on by the Bell System that have important military applications.

Some of these systems are at work today tying together our scattered military forces with communications that have reliability, speed, flexibility, accuracy and security.

In the near future, all of these techniques with which the Bell System is so thoroughly familiar may be used for military communications needs

such as warning, intelligence reporting, logistics operations, and command and control weapon systems direction and administration.

And this is just the beginning.

Every day at Bell System research and development centers, the same kinds of imagination and experience that went into the systems on this page are being brought to bear on even more advanced military communications systems to strengthen our nation's defense.



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and of two or three nuclear power type陀螺仪陀螺仪 constants to manufac-  
tured selected on the basis of 5000 hours  
life; studies completed this spring  
(AVW Apr. 16, p. 75) and supplemented  
with a series of additional programs.

► **Hidded Radars Antennas System**—An analytical investigation is done initially, new types of antenna designs which are inherently adaptable to various configuration capable of withstanding nuclear blast is planned by Rome Air Development Center. Program will include fabrication of antenna ready to demonstrate feasibility.

► **Molten Chloride-Thorium Reactor**—In-Liquid Metal & Space Co.'s corporation to select a contractor for the total conceptual portion of its Molten salt reactor development equipment (AVW June 21, p. 71) in Andover, Calif.-Wright and Sperry Road.

► **Midwinter Wave Motion Project**—Program to investigate multiple question effects in paramagnetic crystals with high internal fields for possible use in nuclear amplifiers operating at the 100 to 300 geV level presently is planned by Rensselaer Polytechnic Institute, Albany, N.Y. To be used in particle crystal detectors such as Fermilab drift and counters, RADC also plans a February investigation of electron beam interaction with plasma for use in an amplifier in the 100 to 1,000 geV band.

► **High Altitude Infrared Reconnaissance-Engineering tools to determine potential value of infrared cameras**—some photographs made at altitudes of 60,000 to 200,000 feet is planned by Rome Air Development Center.



Pocket Receiver

Pocket radio receiver includes selective calling provision to page individual drivers. The transmitter/receiver VHF PM receiver single B battery current 25 x 11 x 54 in. Manufacturer: General Electric Communication Products Dept., Lynchburg, Va.

Reduce Shock Forces!

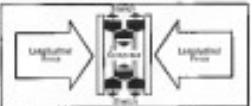


# compact

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Great capacity to absorb shock or vibration in a smaller space is now possible by the unique design of Edgewater Ring Springs. These smaller springs have less than one inch diameter—some can even down to 3/16 inches. The largest—3/4" inches diameter—will take almost a million and a half pounds force. A great variety of springs can be made within this dimension and mass range.

The drawing below shows how the tensile and compressive strength of steel is used to provide a uniform, predictable rating for each size. An important characteristic of Edgewater Ring Springs is the damping effect produced, inherent in a ring spring, effectively damps road oscillation and harmonic vibration.



Edgewater Ring Springs absorb shock over a wide range of frequencies by reason of inertia.

Write for additional engineering information regarding applications, loading characteristics, predictable travel, space limitations, and other pertinent information.

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# "Hardened Eyes" for the Enterprise



The new U.S. *Enterprise*, a sailing full of surprises, is one of the most advanced in the world's fleet today. The world's first nuclear power carrier, she displaces 8,000 tons more than the Queen Mary, and could in end she could be as tall as the Empire State Building. On her sea trials, *Enterprise* did over 35 knots, leaving her destroyer escort in her wake. Her squadrons of impressive helicopters and bombers give her an offensive punch unmatched in history. Like "spies" are now Hughes long range detection and television cameras tracking radar surveillance—hardened as reinforced concrete blast walls. Modern as the *Enterprise* herself, these new *Enterprise*

are a radical flight-line type. In operation they are as maneuverable as planes, and since they have radar beam steering, really. Unlike the conventional "rock and roll" aircraft, these new avions have no pitch to enter into, no fragile mechanisms to break down. Much R&D at the *Palo Alto* facilities.

*Remotely Piloted Air System*—the Hughes *Skystreame*—is the first aircraft ever built using complete computerized—precision range, aiming and steady information without physical contact of man kind.

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## BUSINESS FLYING

### GE CJ610-2B Turbojets Chosen To Power Hamburger HFB.320

**Hamburg-Hamburger Flugzeugbau**, which recently decided to an engine switch for its proposed HB.320 aircraft for transport, is considering a follow-on order for a volume of the aircraft to be introduced in the late 1980s.

Decision to go ahead with the follow-on only a probable starting point at about 20 passengers will depend largely upon the success of the 6-ton Higman HFB.320 whose development cost is now projected at \$4.25 million.

In a major modification move, the German firm has decided to substitute the 2,440-lb-thrust Garrett AiResearch C3010-2B powerplant on the transport aircraft for the originally planned Pratt & Whitney JT12A-5 which had a thrust rating of 3,000 lb.

The decision was predicted upon a variety of factors especially including a GE agreement to share in the developing, engineering, plus generally back up costs from the \$65,000 rating for the JT12A-5 to about \$45,000 each for the C3010-2B.

A Hamburg-Hamburger spokesman said he took the different selection decision on the C3010-2B as "substantially better" and first arriving of the power plant on production models should be more readily attainable because of the use of the C3010 or several other aircraft aircraft now under development.

A related factor is the use of GE

and Electric propulsors in the Lockheed F104G intercepter which the German air force has selected as quick fix as well as the Northrop F-5 and Canadair CL-44 transports both of which are in service to Germany's air force. A GE engine in the HBH.320 Hamburg-Hamburger aircraft offers fuel savings in takeoff weight to the German government's budget and economic transport.

#### Development Costs

Detailed development costs will be shared by Hamburg-Hamburger Bölkow and VFW. A German aircraft and HFB's parent firm, various German subcontractors and the engine manufacturers.

Hamburg-Hamburger also hopes another European aerospace firm, possibly Spain's CASA, will join the project for a partnership basis.

First prototype flight of the aircraft is now scheduled for September 1984. First production flight of the aircraft is due in August 1986 and final production from the end of 1984.

A company market survey shows a sales potential of about 180 aircraft within Europe at a price of about \$700,000 each. The company hopes to find substantial markets within South America and Africa as well as in the United States.



#### Cessna Skynight Gross Weight Increased

Cessna Model 120 Skynight for 1983 has gross weight increased to 1,200 lb. from 1,100 lb. in the 1982 model (AV Dec 25, p. 807). Useful load has been increased from 3,100 lb. to 3,600 lb. Wings and fuselage are strengthened to provide for the increased wing load and the 1983 model has big flaps extended outward at 60 deg. similar to the Cessna 174. Range has been increased to 500 miles on fuel system and Cessna-rated TSO'd 475 lb. Total has been increased to 1,500 lb. from 1,400 lb. with SAE 50W.



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## SAFETY

### CAB Accident Investigation Report:

## Filter Clog Triggers 720B Engine Failure

Trans World Airlines Flight 565—a Boeing 720B, N701PW—departed Los Angeles at 1441 hours Pacific Daylight Time on a day passenger flight to Boston. The aircraft's gross weight was 754,602 pounds with 53,100 pounds of fuel. The run within the previous allowable weight and was distributed within the center of gravity limitations. Captain James A. Doherty was in command of a crew of two and there were 34 passengers aboard.

The flight was cleared to proceed under Standard Flight Rules at 27,000 feet. A visual check in this altitude was completed in approximately 17 minutes. After the check and 10 minutes later, approximately 17 minutes thereafter a high-pitched noise was noted in the No. 1 engine. The vibration or "engine wobble" is referred to by Captain Doherty, who stated he did not notice the vibration during his training. According to the Federal Aviation Administration (FAA), where turbulence was encountered, fuel descent was made to 23,000 feet. In the vicinity of Albany, New York, Captain

and First Officer were unable to maintain level flight for 24 more minutes.

Although no smoke was noted, engine vibration increased.

Shortly after, a settled explosion was felt and heard by the crew and the aircraft came down to the left of the jet. The explosion was immediately followed by a sharp impact from the right rear. The left engine was brought back to a normal flight attitude. The right engine then stalled and cabin pressure was dropping. Through the cabin were on emergency oxygen and secured the seat belt signs. Captain Doherty contacted the tower. Control was transferred to and transponder 9100 feet.

### Hydraulic System Failure

It was noted at the scene that the right engine was still running and the No. 1 engine had failed. The No. 1 engine was then shut down and its oil return line up around one rotated song out the exhaust nozzle. The crew effort then advised that the rudder actuator of the No. 1 engine had dislodged and that the exhaust screen was over the rudder actuator. The right engine was then started. The right engine was activated. The right engine's speed and rate of descent were identical. As the aircraft passed through 19,000 feet, the engine pressure warning light illuminated and the oxygen flow light came on. At this time, the aircraft was approximately 200 feet and the descent was composed of this power speed.

Wests and First Air Force Base was alerted in the event that the condition of the aircraft would not permit continuation of the flight to Boston. The aircraft came down to the left, apparently lost left direction above the left engine. The aircraft was in a steep climb, and then descended to the left. There was evidence residual heat remaining in the engine in form of a hole one inch in diameter on the front fairing.

The captain decided to continue to Boston because of favorable weather conditions, engine length, and available emergency equipment at that location. The cables to hydraulic was thoroughly checked by the captain in emergency procedure and the pressures were shared of the extremes. All emergency gear and flap extensions were deployed. The aircraft was then in a landing configuration (IEE) was effected with ground emergency approach landing to Boston. The aircraft was able to compensate for the low rate of the approach. No. 1 engine and the total loss of fuel from its startup until the aircraft reached the ground, totaling 200 pounds and the descent was composed of this power speed.



### Changes Shown on Belvedere Helicopter Production Models

Production models of Bell Air Force-McDonnell Belvedere twin-turbine, long-range transport helicopter are shown carrying cargo in slings. Production models incorporate modified tailboom, heavier straight tail boom with "stacked tape," bags on bottom of landing gear, all of these losses power ratings, and larger line behind that is a downward engine outlet. Small intake above rear ribs serves function of cooler. Rear engine intake is under bridge and directly off of rear cooling gear.



## TO THE TARGET...

Eclipse-Pioneer Dead Reckoning Computer Systems are designed to do a complete navigation job—particularly ideal for one-man aircraft where the pilot has to do everything himself. We've been producing them for the military for almost three years, but commercial carriers operating trans-oceanic routes will find them equally useful. They've been successfully flown on such aircraft as the F-100, C-130, F-105, A3D, A4D-2, A4D-2N, F4H-III—about 2,000 are currently in

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The self-contained system gives constant readings in latitude longitude to a preset target with no outside aids . . . can be reset en route to other targets. It requires miles-to-target or miles-from-base and can



## AND HOME AGAIN!

even be used as a steering indicator or to plot a lead collision course to any moving target . . . and, of course, horns aye.

The AN/ASN-41 has an automatic wind-memory feature for use with doppler or inertial sensors. It can make position corrections as needed. It can be bed in with plotting boards, position recording equipment, auto-pilots, inertial platforms, and bomb/NAY computers. The system also features digital tech-

niques. Modular construction offers simplified maintenance.

For nearly four decades our business has been the design and manufacture of specialized navigational systems for aircraft. The AN/ASN-41 is the latest example of this capability.

Whatever the navigational problem, if it can fly, Eclipse-Pioneer can solve it. We can be reached in Teterboro, New Jersey.

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THE FUTURE



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*An idea in the mind of man... that's where every achievement in the world begins. Peer into the minds of Lockheed Scientists and Engineers. There you see: Ideas in the making—ideas that some day will take on form and substance. Not all, of course. Some are too "far out." But no matter how visionary, all ideas merit serious attention.*

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the aircraft crossed the north meridian by turning left on route 15. At this time west and heading precision had been disrupted and subtracks were used in bring the aircraft to a full stop over runway 14. The passengers do not appear to have suffered any injuries through the hard compartment door.

Crossed navigation of the aircraft revealed that several engine annular and instrument bid failed to function properly when a return sector above of 10,000 feet was reached. During the descent from 10,000 feet to 5,000 feet, engine failure failed to depressurize Air vents D/C and D, 10 A and B, and 21 A and B. However, no passengers occupied these seats. All passengers claimed observed their engine winds successfully. The oxygen mask was deployed in the cabin. It however, G and D in the left cabin appeared but the masks failed to drop out. It appeared that these masks had been stored uprightly and were not right or loose continues.

One of the passengers stated that she was seated in the last row on the left side of the cabin. She was sleeping when the plane did just pass to the right of India. She witnessed several sets of flares or red and green streaks later over the No. 1 engine pit door. Subsequently the left the aircraft shoulder and then walked out. Measurements indicated that the center console in the cabin had dropped. The main gear had failed to drop and had to be re-armed manually. She and the other seven crew and passengers emerged safely and made their way to safety in spite of the passengers and crew themselves that did over properly recommended.

### Weather Sequences

The Khayyam and Bustan 1500 weather station for November 5, 1964 gave an Al band-to-electrode 200 foot voltage, sky obscured, visibility 8 miles, light rain and fog, temperature 57°, dew point 57°, wind 10 mph, gusts 15 mph, 1000 feet broken high clouds, visibility 15 miles, plug temperature 75, dewpoint 65, wind northeast 17.

An investigation at Bustan revealed that the No. 1 engine pit door was ruptured in the rear section of the door. The bottom section of the door and upper section were completely separated from the engine pit door remained attached to the pilot access. Approximately 80 percent of the bottom section was torn away during removal. The only portion of the bottom section which remained intact was the forward support frame of the second stage landing gear which was still attached to the landing gear on the tail fin base itself. A vertical component of the tail of the second stage landing gear was cut off from the bottom section of the door. The top section of the door had a longitudinal crack. The remainder of the door was not recovered. Approximately one-half of the front stage landing gear door was ruptured in the ground near Bustan. The remainder of the door has not been recovered. No portion of the front stage landing gear door had been recovered.

There were numerous holes of various sizes on the left wing and fuselage which account for the relatively rapid disintegration of the tail section. The outer left wing tank was punctured in several places. The left wing was torn through approximately one-fourth length of its width. Fuel loss, apparently

## PROBLEMATICAL RECREATIONS 130



A man leaves from the point where the plane terminates across the equator and moves forty-five degrees northeast by geographic compass which always points toward the north geographic pole. He correctly corrects his course. Assuming that he walks with equal facility on land and sea, where does he end up and how far will he have travelled when he gets there? —Continued

See game klystrons, microwave transistors, rotary magnetic memory drives? We hope so. And you who desire of amazing products at the ready like MESCOM Show this month Booths 429-31 and 528-32 will house displays from our Aero Services Corporate Business Tube Division, Thord, USECO and Western Receiving Divisions, and the Guidance and Control Systems Division of Litton Systems. We'll be in the Main Areas on the even floor. Welcome one and all!

ANSWER TO LAST WEEK'S PUZZLER: Let  $N$  be the smallest integer. The product of the first  $(N+1)(N+2)(N+3) = (N^2 + 3N + 2)$  and the last  $(N+1)(N+2) = (N^2 + 3N + 1)^2 - 1$ . This is not a perfect square since 2 positive squares cannot differ by 1.

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# INTERNATIONAL AIR TRANSPORTATION ISSUE



## SEPTEMBER 10, 1962

The impact and challenge of recent trends and developments in international air transportation will be the subject of AVIATION WEEK & SPACE TECHNOLOGY's International Air Transportation Issue, September 10, 1962.

This major editorial effort will analyse the direction and problems associated with the growth and expansion of air transportation in all major world markets including Atlantic, Europe, South America, Africa and Asia.

Subjects slated for special emphasis are: Development of a new U.S. international air policy; Worldwide impact of common market and African conventions; New flag carriers of emerging nations; New trends in supersonic transport research; Communist bloc penetration in world air markets; 1948 traffic trends; and future international tariff and merger problems.

Copies of this issue will be airlifted to delegates at the opening session of the International Air Transportation Association (IATA) Conference in Dublin, Ireland. There will be gathered the international leaders of air transportation whose attention and discussions will be focused on these and other major issues.

With Aviation Week's reputation as the authoritative, respected voice of international aviation, the International Air Transportation Issue will receive world-wide readership and impact.



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#### **English Electric Lightning Mk. 5 Shown**

New version of the English Electric Lightning represents fighters from British Aircraft Corp's Bristol aircraft plant at Filton. Version 2 has been altered from previous versions.

The rice book had appeared from the fourth stage nucleus and was being in the No. 6 housing support.

## **Engine Disassembly**

Damselfly of the major species heavily infesting little ripa and lake reed beds in the low coniferous. In addition there was some feeding between the blades and leaves on both leafing and fruiting stages. The *N. leucostigma* was severely damaged and the *N. t. t.* of art was fractured in most places. The submerged flowering areas were also fed on and many of your types of *lutea*. The *N. 2* became very pale and the *N. 3* were also severely damaged. The *N. 4* were moderately damaged. *N. 5*, *N. 6*, *N. 7* and *N. 8* remained well but were heavily damaged. The eggs laid by the long coniferous was fractured in the place at the *N. 2* bearing. The "O" ring tests will be continued in the grasses of the high coniferous forest belts.

Nothing was noted at high shade tops and knoll-ridge areas. Heavy concentrations were found in the No. 4 area.

The engine, Serial No. P-54590, had been removed from flight status on September 12, 1951, because the air breather pipe was in excess of the 10-inch 16-lb. limit. Total engine time—167 hr. 45 min. The engine was delivered to the U.S.A.F. by the Pratt & Whitney Aircraft Division, Several parts of the engine were reconditioned or replaced and the No. 4 bearing housing needle race and retaining O.D. were replaced. The end shank supports which were machined in the housing were machined to fit the bearing housing. A new bearing housing was machined and fitted around the No. 4 and No. 5 bearing components. Parts Pratt & Whitney Service Bulletin 248

and 2% in order to reduce the transfer of heat to the engine oil and to improve oil scavenging. The high compression cooler pipe was made plated at each end to increase the insulation by per cent.

### **Services Offered**

The No. 21 bearing mounted on the rear hub of the front suspension was powdered by the shelling as shown by the damaged housing, the intermediate bearing housing remaining intact. The No. 11 side plate merged with the outermost bearing housing leaving them down the No. 1 trail. A photograph of the No. 11 side plate indicated the presence of a front probe about 7,000'. The No. 5 bearing also mounted on the rear hub of the front suspension failed and allowed the high

compared to older ages. The rate was evaluated by two methods, the mean age and the mean age of death. The 74 living married men were compared with the 76 single and widowed men. Trends leaving traces of the new pollen path. Metrelic deposit began to dominate on the convex slopes of the first sandstone glacioclast from crevasses blocks were derived. Large and elongated blocks about 1 m. thickness of the talus of the high meadow dish in the low altitude meadows.

POLYMER LETTERS EDITION



## GUIDED TOUR

BY AC

**AC Spark Plug** The Electronics Division of General Motors has announced the first children in the family of electronic components of a comprehensive guidance system for the final phase in NASA's APOLLO project of manned flight to the moon. This new component is another significant step in the program that is being built at AC — progress achieved through the know-how of AC highly skilled, highly respected staff of engineers, technicians and scientists.

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the men who were seated in the tail section who was looking and the window showed the No. 1 engine. Noting of burns coming from the engine, he spoke to the forward air controller to move the plane down closer to land, lower the gear, back up and shutdown the No. 1 and No. 2. The last burns were the insulation of the fuselage damaged by the compressor blades rubbing the engine.

The last major cause of the final explosion was the deterioration of the No. 2 bearing, where the steel balls were not fused to the outer ring. As the heat compressed over balls rotated in the bearing, the bearing race ring was both gummying and losing the power of the ball. The shrapnel generated from the explosion came from the decompression generated by the last shell, began to exceed the last yield point. The ultimate strength of the lead was exceeded. The lead sheared through the thermal, aerobraked housing plate made for small lead weights, decapitated the fin for the last time. The last remaining lead.

Since the low compression can no longer absorb the energy that the gas nozzle was extracting from the engine, the low pressure swirls begin to accelerate. The turbine disk mechanical heating increased with the impact of the shrapnel and the heat was absorbed through the disks until it was so hot that it burst through the casting cooling and nozzle passage. Meanwhile, the low compression rate slowed down and was partially caused by the outer structure. The outer casting edges then began to melt with the last leading edge.

### Fitter Clipping

Off Ellen captain and Bill up with metal fit particles from the break up of the dust seal bearing. The high solar winds are still setting high. The clouds far out of the high altitude clouds as it passed and shifted toward the west. The sun was still visible, however. A quick check of furnace blower indicated no excessive overtemperature.

Estimation of the current deposits on the low turbine disk shaft which passes through the center tube indicated that the shaft blade at linkage oriented at the front and midplane voltage is the use of the rear of the center tube.

The bearing capsule with carbon carbon insulation and the high temperature or insulation of the No. 2 bearing insulation and overall shaft produced enough energy to combust the oil residue causing the fire to spread to the rear.

It should be noted that on October 11, 1969, Peter & Whitney Aircraft used all aircraft engines. "W" establishes of heat shielding being incorporated without complete insulation requirement resulting placing of distance from the aircraft to the ground. However, testimony of TWA's personnel indicated that the subject capsule had probably been exposed beyond the stage II if the above information was accurate. It is therefore believed that the subject men were not released from the aircraft to prevent the possibility of insulation.

In addition, although the main air filter was removed prior to the initial flight, it was not disseminated and was given such a coarse examination, therefore any internal contamination could have gone unnoticed.



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### systems analysts

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Examination of the debris mat showed a heavy carbon deposit around the heater tabs and the turn shelf packed with carbon. Examination of the No. 3 support also revealed carbon on the outer walls. An analysis of oil samples indicated no significant differences.

### Rejected Theory

The Bureau test results show that the two cracks between the rear compressor front hub and the No. 23 housing were created during the previous FMEA repair and modification. This was based on the condition of the seal and gaskets, seal clearance, the other seal joints, the condition of the turn shelf and the fact that the turn shelf edge itself would have broken through this opening and started breaking down from within the No. 2 area. It is believed that a nearby particle accumulation of carbon dioxide would have been present at the time of the repair and caused the heat damage. The damage which was found can be attributed to the heat transfer through the No. 3 diaphragm which is attached to the resulting heat arrester.

A hardness check of the gaskets indicated that the hub had been subjected to temperatures high enough to cause the gaskets to become soft during the failure sequence. Heat could then have blown the gaskets clear before or after the repair was able to have been deposited. Although not conclusive from the evidence it appears unlikely that this was the case.

The remaining portion of turbine disk engine has been a source of concern to the industry for a number of years. Recognizing this problem, the Administration of the Test and Evaluation Agents has required certain design features and passed testing of turbine engines on units to be applied to the type model. In addition, the manufacturers have developed such tests and effort toward meeting turbine disk engine. Despite these precautions, this failure and other turbine disk engines have occurred in engines in operational service.

In the case of the current aircraft, caused by the destruction of the engine, it is believed that warning could have been given in the new by reference equipment and would have allowed for engine shutdown prior to the failure. Indeed, Executive Chairman's cold start procedure, which is used in the aircraft as the No. 1 engine failed. Although the state of the art does not allow absolute certainty, it must be established at this point, a relative initial can be established by which an abnormal shaft force is associated with the failure. This can then be used to trouble-shoot and eliminate before entering engine damage mode.

To provide sufficient warning against such failures the Board has recommended to the Federal Aviation Agency that suitable instrumentation, with the relative testing equipment described above, be installed in commercial turbine aircraft.

### Conclusions

No. 3 engine experienced a vibration of the No. 2 bearing retainer housing due to the loss of compressor fan hub shims, loss of turnshelf and heating of the shear plate radial disk.

Oil starvation of the bearing was caused by chipping of the "thin-walled" sleeve

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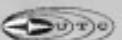
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well carbon deposits from the Nos. 4 and  
5 heating areas.

Ceramic linings were formed in the Nos.  
4 and 5 heating areas by ceramic outer  
wall temperature and high pressure center  
wall leakage.

The actions taken by the crew during the  
emergency were found to have been in ac-  
cordance with applicable codes and  
regulations. They performed their assign-  
ments safely effectively and expeditiously.

Weather is not considered to have been a  
factor in this accident.

### Probe/Re-Cause

The board has determined that the prob-  
able cause of this accident was start of vibration  
at the No. 2 heating area during the  
initial phase of the test.

This precipitated the failure of the  
low pressure compressor seal lob and the  
subsequent and subsequent disengagement of  
the low pressure turbine section.

By Carl A. Anderson, Board  
Alan S. Bond, Chairman,  
John C. Gandy, Vice Chairman,  
Chairman, Member,  
William C. Gilford, Member,

Investigation and Depositions

The Coast Guard Board was advised  
of its accident shortly after occurrence. An investigation was conducted at the scene  
and the Coast Guard Board convened at the  
Tulane Aviation Art of 1949. Depositions were taken at the Legion Innkeeping  
Agency, Boston, Mass., Dec. 18, 1981.

Captain Kenneth A. Dakubo, age 40,  
held a valid seaman certificate and current  
seaman rating (No. 14675). He passed his  
last written examination on August 16, 1981, with no minimum. Captain Dakubo held  
officer ratings (No. 14675, BC 4, Master, 200-250 tons, Lockheed Constellation  
and Boeing 727 aircraft). He held a total of  
15,127 flying hours, 21% in the Boeing.

Captain A. Hodge held a valid  
seaman certificate and current  
seaman rating (No. 14630). His  
last written examination (No. 14630, BC 202  
400, Lockheed Constellation, Boeing 707  
720, Captain) passed on April 1, 1981, with no minimum. Captain Hodge had 10,000  
hours total flying time, 21% in the Boeing  
707, 17% in the Boeing 720.

Hector F. Wilson, Second Officer, held  
a valid seaman certificate, No. 124517. His  
last valid medical examination was dated January 26,  
1981, with no minimum. Second Officer  
Wilson had a total of 13,000 hours, 21% in the  
Boeing 720.

Edie Smith, Flight Engineer, held valid  
light engine, mechanic, conference and  
pilot/engine and FCC aircraft radio license  
plus flight engineer ratings. She passed her last medical  
exam without examination on July 19, 1981.  
Flight Engineer Smith had a total of 10,000  
hours total, 21% in the Boeing 720.

The crew consisted of Captain L. Schenck,  
First Officer J. H. MacLean, Barbara Smith, and  
Castie Dako.

N-707W, a Boeing 720B, serial No  
1328, was manufactured August 22, 1968.  
The aircraft was leased from United Air  
Carriers Company and operated by UWA. It  
had a total of 10,000 flying hours since manu-  
facture. The aircraft was managed by four  
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## WHO'S WHERE

(Continued from page 13)

### Honors and Elections

National Astronautics and Space Administration astronauts are Space Admirals—honorary colonels and two officers for leading the X-15 project to outstanding success among space veterans. NASA distinguished Service Medal to Dr. Joseph A. Walker, NASA Maj. Robert M. White, USAF, and Col. Paulann S. Pennington, USAF, for outstanding leadership in the X-15 program; NASA Distinguished Leadership to Paul Bille, Director of Flight Research Center, and Robert E. Scott, Assistant Director of NASA Langley Research Center, both for outstanding leadership.

Brander Warren D. Morrison (D) was recently selected by the Joint Board of Staff to receive the 1970 annual National Transportation Award of the National Defense Transportation Association "for achievements in transportation which contributed to the effectiveness of the transportation in funds or support of national security."

### Changes

The Los Angeles (Gold) Aerospace Division of Marconi-Honeywell Raytheon Co.'s Military Products Group has announced the following appointments: Bob Blum, director of advanced programs, George C. Clegg, director of operations; J. A. Rummel, vice manager; Jack Cooper, manager; P. Wagner, Salesperson, aircraft sales. Formerly, all were with Pacific Bell Electronics.

Ken Davis, editorial and program director, National Aerospace Council, Washington, D.C.

Russell McClellan, formerly director of public relations, also promotion and advertising in Denver, has established Russell McClellan and Associates, Washington, D.C. in pursuit of business consulting and advertising.

Walter F. Bowes, director of employe development, United-Carrier Products Corp., Canada.

John F. Hanes, director of plant and programs, MW Devices Inc., a division of Matsushita Electric Industrial Co., Japan.

In Col. William C. Abshir, chief of a new Electronics Design, Development, of Engineering Services, Air Force Office of Scientific Research, Washington, D.C.

Cpt. Jack L. Morehouse (USA), selected to be the first commanding officer of the Air Force Space Test Commissioning Agency, Wright-Patterson AFB.

J. Guy McGee, general manager, Electro-Optical Systems Division of Rockwell Science Corp., Pasadena, N.C., succeeded Maxine Grotto, who assumed the position of E.O.S. president, for the AN/ALBT-3 laser beam steering program. Maxine Grotto, former director of science division, Electro-Optical Systems Division.

Dr. Michael S. May, associate director for surface design, Defense Research Laboratories, University of California, Livermore, Calif.

Dr. Michael E. Lowrance, chief scientist, Material Products Division, Rockwell International Corp., Los Angeles Calif.

E. D. Hart, assistant manager-astronaut products, Boeing宇航 Division, Baltimore, Md.

John L. Crookshanks, assistant marketing manager, Radio and Sensors, Avco Corp., Easton, Md.; Robert D. Johnson, assistant staff supervisor, S.M. Schatz, program operations, W.L. Sommerville, war rating.

William E. Murch, assistant general manager, management services, Douglas Aircraft Company, Long Beach, Calif.

Ronald M. Young, director, Logistics Department, Hercules Systems & Products Division, Marconi Co., Baltimore, Md. Also: William J. Novak, director of public relations, Marconi Co.; a Space Systems Division.

Dr. James T. Arnold, manager, Sprayed Products Group, Instrument Division, Virginia Vessicles, Falls Church, Va.

Kenneth B. Van Every, technical assistant to the vice president and assistant general manager, Technical Division, Naval Ordnance Test Station, White Oak, Md.

John J. McCabe, managing engineer, Strategic Systems Division, Lockheed Instruments Inc., Palmdale, Calif.

B. H. Wilson, director of public relations, National Airlines.

Dr. George Glassell, director of engineers and procurement, General Research Associates, Inc., Cambridge, Mass.

Donald G. Craine, senior engineer, Recovery Department, Racetrack Corp., Cleveland, Ohio.

Stanford Sales, product planning manager, Lyndhurst Corp., Long Island City, N.Y. John F. Doherty, director, M. S. Sales, as product planning manager.

Robert F. Andelson, director of marketing, Hayes Aircraft Co./General Systems Corp., El Cajon, Calif.

Frederick P. Seeger, manager of product planning, Union Division of Sperry Rand Corp., New York, N.Y.

Bernard R. Diamond, manager of navigation systems, Thermo Electron Corp./Spectra Operations Center, Ridge, N.Y.

A. M. Collins, supervisor of research and development, Allis-Landis, Milwaukee.

William J. Chappell, director of solid-state microwave radar, Microtek Microwave Division, The Garrett Corp., Phoenix, Ariz.

Dr. Jerry Koff, principal and consultant, Systems Engineering Department, Avco Corp., Woburn, Mass.

E. Scott Powell, general manager, Aerospace Division, American Manufacturing Corp., Baltimore, Md., succeeded Charles Feltz who is returning to the corporate office of American Optical. Cited as during the company's long range planning process. Also Edward J. O'Neil, project manager, Middle Division of American Optical.

Marconi Industries, Monrovia, Calif., has announced the following changes in the Components Group: Dick Gross, general sales manager, Electronic Products and Wide Band Magnetics Division; W. Ross Bishop succeeds M. Gross as director sales and marketing, Electronic Products; Gordon Elkins, director sales manager, Wideband Magnetics.

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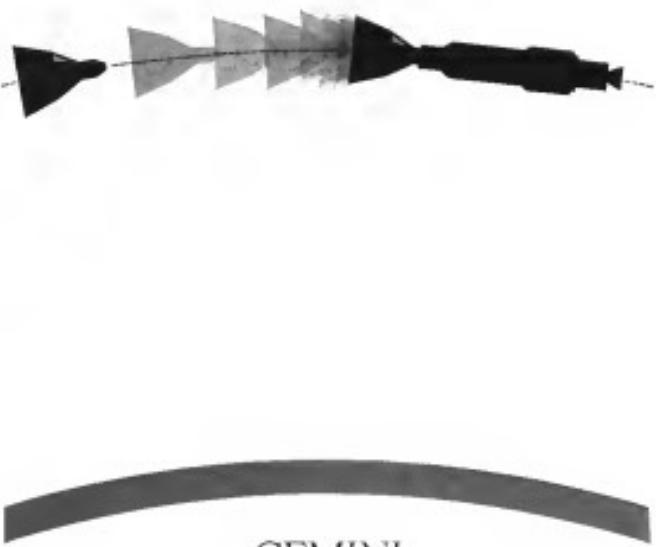
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# LETTERS

## Engineer Comment

The pilot flight response despite information he has had is good. Perhaps the FIA have a better publication than we do. I hope that I have not sold any pilot information.

It is difficult to believe that the FIA have been able to hold such strength with so little progress since they are using. In the business world - and here is the USAF, with money to burn - it is not hard to look for other "easier". We should still have either up grade or determine whether their skills are not even in though otherwise.

The flight responses have an ease and measure of trouble on the third flight. First, first rate, however, the flight seems to be working.

See also "Booster designer" or "boosterized" applied to the pilot when he has probably not even flown off the ground more than once.

The flight responses want to keep the ADT and its window. Why not let them do it - on the ground, where he can see them?

Curt JAMES A. Scammon  
USAF Pilot  
Altus City, N.M.

As a former airline pilot, I have difficulty in understanding the pilot stand-off of pilot error syndrome. It happens to leave the cause and possibly all involves a pilot error, but when it is 15 to 20 days away from impact, how can one possibly expect the pilot to make a return? It is much easier to suggest that there needs to be an equal amount of time before "quarantine" is applied, and assuming that he was 18 years old when he started, he will have reached the maximum sentence age before he would be eligible for requalification.

The theory that a well-rehearsed set of survival skills does not hold any cache in the bottom-line judgment would be the case to fall off. It opens the eye to see that strength must also be physical to survive. If the pilot's physical reserves are sufficiently dropped, he will need the maximum sentence age before he would be eligible for requalification.

Davis E. KELLEY

Bethesda, Md.

## Invention Rewards

At Mr. Gibbons' last letter to Aviation Week, June 21 (p. 302), has applied in substance to a characteristic of a human being which could be classified as a latent trait. This latent trait is the desire to be rewarded for his efforts. There is, however, no room in a system to be neither the incentives of India, nor design engineers to take a more formal concern and are not being adequately compensated for their professional services. Those holding high salaried posts in engineering firms hold a wish to receive wages for their hard work plus an incentive whereby their effort has the "rewards" in demand additional compensation than what is agreed upon originally. The term compensation should not be a general one to include such items as bonuses, recognition, promotional, special privileges etc.

I get the distinct feeling that Mr. Gibbons is referring to "self." He often refers to himself as the "unstoppable" "prince," but unless his sensations have to carry him identically, it would seem that the kind of thinking is born of the sense of the de-

signers to be an individual without the personal and monetary value involved in such compensation. I am referring to the single engineer and his desire to reward by his capabilities. In the meantime, we have had several in the course of his aircraft who however has aptly called this "having one ride and eating it too."

An engineer without the depth of character to reward the risks of parts would not be a good house, under whose leadership would another.

I agree with Mr. Gibbons that no engineer's design does not automatically merit in the individual's compensation. The basic engineering education requires no reference of this kind, but my graduate engineer believes that his design engineer only makes a Python, Snakes in Kettles is looking lower in weight, sense of his identity in the free place. The pattern is only of formal reporting training may be limited to a small extent in the application of this kind of knowledge to the majority of mathematical and mechanical engineers, but once separated the engineer can easily teach the student to think and specifically to think in a mechanical language.

James P. COOMBER  
Engineering Manager  
Dodge Aircraft Co.

## Bomb Deterrent

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2. Mine or arm spread and position so that, if a given large area is scanned, mine sites within this are compact, all places are equal.

3. Integrate all predictors of large aircraft.

Sergeant CHARLES  
Drummond, Ph.D., D.Sc.  
Cornell Aeronautical Laboratory, Inc.  
Cornell University  
Buffalo, N.Y.

## Michoud Location

I read with interest your news story of Michoud's operations in your issue of July 2.

As a New Orleans' person of my city's past in holding the Sunbeam location, I wish to point out that the Michoud plant is not located 17 mi south east of New Orleans.

This is a geographical error I have noted in practically all national coverage of the Michoud operations, which may have its explanation in an early government release that the large Lockheed plant is 17 mi from downtown.

The Michoud plant, located on the former Michoud plantation, is completely within the city limits of New Orleans. And it will remain so.

Carroll M. GORE  
Public Relations  
New Orleans, La.

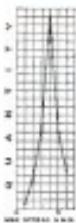
## Dollars to Autos

I read with interest your article in the July 18 issue (p. 10) on the survey made to rate the auto traffic that could be possibly diverted to the highway.

There were several reasons given as to why auto traffic would be low, each of which possibly had some merit. However, I



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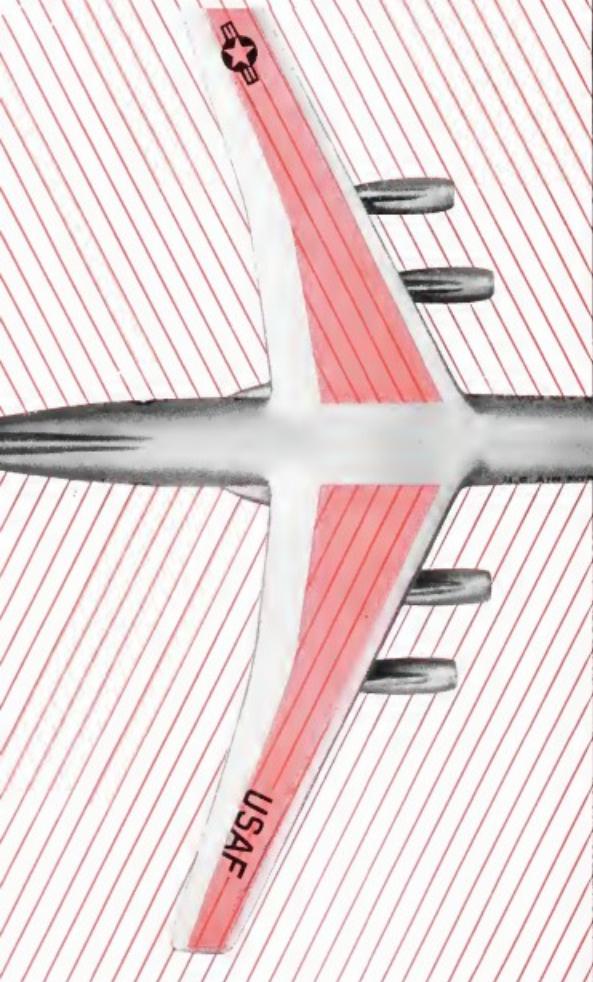
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**Wing box beams** for the USAF C-141 turbofan transport are being made by Avco's Nashville Division, under subcontract to the Lockheed-Georgia Company, a division of Lockheed Aircraft Corp. These box beam assemblies, which include much of the wing, bear most of the plane's weight when aloft. Lockheed relies on Avco for the needed combination of strength and lightness.

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Lockheed C-141 has wing box beams built by Avco/Nashville

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